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ARTICLE

Assessing the Impact of the “Two-child Policy” in China: The Effects of the Second Child on the Growth of Teenagers

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Abstract: Purpose: China’s new universal two-child policy has brought a baby boom of the second child in 2016. With the changing family structures, elder children in adolescence may have more and more emotional and even psychological problems such as “two-child syndrome”. This paper aims to explore the “influence factors and mechanism of the second child on the growth of teenagers” and has great practical significance to promote the physical and mental health of teenagers and the harmony of two-child families. **Design/methodology/approach:** By means of literature analysis, in-depth interview, questionnaire survey and statistical analysis, the elder children aged 12 to 18 in the two-child family were taken as the main body of the survey, and an empirical research based on NLP understanding hierarchy theory was carried out. **Major Findings:** (1) The most significant influence on the growth of teenagers is the attitude of parents, and then the gender of the first child. (2) Parents’ favouritism towards the second child would lead to decline in the first child’s academic performance. (3) The higher the family income, the less the influence on the first child’s life. (4) When the age difference is large, the first child and the second child are not easy to have conflicts. **Practical implications:** Parents should try to treat any children equally. Parents should pay attention to the sibling relationship of their two children with small age gap. Parents who have two children with a large age gap should properly guide the elder child to help take care of the younger brother or sister. **Originality/value:** This study contributes to the growing literature focusing on the influence factors and mechanism of the second child on the growth of teenagers in the context of China’s new universal two-child policy. It adds some early empirical insights on the physical and mental health of teenagers in two-child families.

Keywords: Universal two-child; Growth of teenagers; Empirical research; NLP understanding hierarchy theory; Econometric model

1. Introduction

Introduced in 1979, China has implemented the one-

child policy for more than 30 years, and the “a family of three” structure has become the main family pattern in China. However, with the aggravation of China’s ageing

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population, one-child family planning has had a distinct influence on China's fertility rate, causing changes in China's population pattern, especially the increasingly prominent problem of ultra-low fertility rate. Lopez and Veiga (2020) analyzed the commonly attributed demographic consequences of the one-child policy: decline in fertility, decline in population growth, accelerated ageing, increase in gender imbalance and in marriage market imbalance^[1]. In 2016, China decided to implement a new two-child policy. According to the birth population data of 2019 released by the National Bureau of Statistics: the birth population in 2019 was 14.65 million. The second children account for 57% of the total. It indicates that the universal two-child policy has played an important role, which has accordingly changed the original family structure of only child in China. At present, most of the elder children in the families with two children are still in adolescence and have strong self-awareness. At this stage, their emotions and psychology are extremely unstable. Under the influence of many factors, many psychological problems have emerged^[2]. In addition, many of the elder children's classmates are still only child in their families. The appearance of the second child is easy to cause a comparison with the only child classmates, and then lead to the changes in behavior and psychology of the elder children. As indicated by Cheng (2021), family upbringing has a very important impact on the physical and mental health of teenagers. Positive or negative parenting styles will make children grow up into teenagers with different characteristics^[2]. According to the Pew Research Center, Generation Z (Gen Z) consists of people born between 1997 and 2012. That means, the most of elder children in the two-child families belong to Gen Z. While Gen Z have quite different characteristics. A survey in China indicates that 63% of GEN Z in China feel lonely despite being surrounded by family and friends^[3].

In the process of a person's socialization, adolescence is the key period of socialization, and family is an important place for socialization. The arrival of the second child as the new member in the family and the change of family structure would make the elder children have a psychological gap. The second child would bring many influence factors on the growth of teenagers. For example, changes in family environment, age gap between two children, gender combination, birth order, etc. would have a significant influence on the growth of elder children in adolescence. In turn, the growth of teenagers would have a crucial influence on the implementation of the two-child policy. So it is necessary to study deeply about the teenagers' views on the two-child policy, the root sources for different views and influence factors.

With the increasingly prominent population aging in China, China has fully implemented the two-child policy. Many families have begun to plan a second child. However, many families have a "wait-and-see" attitude, with the reasons of economy, life quality, and working pressure, etc. The most important factor is to consider the influence on the growth of the only child in the family, which mainly refers to the group of teenagers. The physical and mental health of teenagers has always been a significant topic of social concern, and it is also one of the crucial goals of family education. Discussing the relationship between the second child and the physical and mental health of the middle school students under the background of the two-child policy has far-reaching theoretical and practical significance. It can provide guidance for the parents who are planning a second child on how to carry out correct family education in the future, and for schools to cultivate the physical and mental health of the elder children in adolescence.

The increase of the newborn population in one-child families means the acquisition of new identity for the elder children, the emergence of sibling relations, and the complication of parent-child relations and family relations. Therefore, this paper focuses on the changes in learning, life, family member relations, psychological status and other aspects (i.e., the second child syndrome) of the elder children in adolescence under the background of the two-child policy, so as to analyze the causes and mechanism of the changes, and then figure out the physical and mental health of the elder children in adolescence. This will help to identify the influence factors and mechanism of the second child on the physical and mental growth of the middle school students, thus to put forward effective countermeasures and suggestions for the two-child families and schools in actively dealing with the relationship between the two children and scientifically guiding the physical and mental health of the teenagers. In this paper, the whole empirical research covers 407 valid questionnaires. Python is used to mine and explore the data, and an econometric model is established to deeply study the influence factors and paths of "the second child" on the growth of teenagers. In addition, combined with the questionnaire survey results, an in-depth interview was made on five students with siblings, which is compared with the empirical research results.

This paper aims to explore the "influence factors and influence mechanism of the second child on the growth of teenagers" and has great practical significance to promote the physical and mental health of teenagers and the harmony of two-child families. The research results can also be used to formulate effective family and school educa-

tion guidance measures so as to promote the physical and mental health of the elder children.

The remainder of this paper is organized as follows. In Section 2, we review the relevant literature. Research data, variables, and methods are given in Section 3. And, combined with the NLP Understanding Hierarchy Model, Section 3 provides a dependent variable system framework of the second child affecting the growth of teenagers. In Section 4, results and analysis of both prior interviews and questionnaire survey are given. Section 5 concludes the paper. Finally, Section 6 provides discussion and suggestions for future research.

2. Literature Review

This study is related to three streams of relevant literature: the influence of the two-child policy on the behavior and psychology of the elder child, teenagers' views on the two-child policy, and influence of the family environment on the two-child policy.

2.1 The Influence of the Two-child Policy on the Behavior and Psychology of the Elder Children

Based on the survey data of the Rural-Urban Migration in China from 2008 to 2009, Fan (2016) employed self-esteem, mental stress, and depression as indicators to measure mental health. The results show that as the number of sibling increases, the mental health indicators of children initially increase and then decline^[4]. Jiang (2017) investigated the problems in the education of adolescent children and the ones of elder children in the two-child family by questionnaire survey and case analysis. It was found that the problems were mainly in the aspects of mental health, health habits, time concept, and learning quality^[5]. By questionnaire survey on 502 elder children and their parents, Zhang (2019) analyzed the causes of the elder children having psychological problems^[6]. By analyzing cases of "peeping" behavior of the elder children in two-child families and interpreting its phenomenology, Zou and Zhang (2019) believe that behind the "peeping" behavior is the adjustment problem of the children due to the changes in their living environment, which is mainly manifested in existential anxiety and the crisis of self-identity caused by it^[7]. From June 2017 to December 2018, Sun Ya, et al. (2020) selected 80 two-child families from both Mogolian and Han nationalities, using the hospital self-designed questionnaire to investigate the psychological and behavior changes of the elder children after the birth of the second child^[8]. The study found that the top three positive psychological behaviors are strong sense of responsibility, caring for others and knowing how

to share. The top two negative psychological behaviors are physical symptoms and inattention. Taking the two-child policy as the background, Guo (2021) found that the elder children are difficult to adapt to the changes of their roles and positions, and are prone to psychological problems such as jealousy, emotional fluctuations and lack of awareness of independence^[9]. Zhang (2019) used the case study, taking a two-child family in a Shenzhen Primary School as an example, to explore the current situation and causes of parent-child conflict in the client's family, and suggestions were put forward to improve parent-child conflict in two-child families^[10]. Peng (2020) studied the influence of birth order in the two-child families on middle school students' mental health by empirical methods, and concluded that birth order negatively predicts mental health problems of middle school students^[11].

2.2 The Teenagers' Views on the Two-child Policy

In order to investigate the post-1995 generation's attitude towards having a second child in the families, Zhang (2021) investigated the post-1995 generation in Hangzhou with questionnaire in a number of factors such as the education level, expenditure level and the situation of only child^[12]. Based on a survey of 427 teenagers, Hu (2016) analyzed the influence of age and gender factors on whether teenagers are willing to accept their parents to have second child^[13]. From the perspective of the implementation of the two-child policy, Wang and Qu (2018) believed that the vast majority of teenagers who resisted this policy are due to psychological reasons^[14].

2.3 The Influence of the Family Environment on the Two-child Policy

Drawing on data from the China Family Panel Studies (CFPS), Hu & Shi (2020) assessed the state of gender equality among Chinese children under the one-child policy^[15]. Xiao and Wang (2020) used the cross-sectional data of "CFPS2016" to analyze the influence of housework support provided by elderly parents on the second child-bearing status of their children's families^[16]. Li et al. (2020) explored the child-bearing desire and influence factors of the new generation of women under the background of the universal two-child policy^[17]. Jia et al. (2021) studied the influence of the family decision-making for the second child on family financial asset allocation by taking the "two-child policy for couples of which one partner is an only child" and "universal two-child policy" as quasi-natural experiments^[18].

In summary, very few existing literature has explored the influence of the second child on the growth of elder children

in adolescence from the perspective of the elder children with the four dimensions of learning, life, psychological status and family member relationship. There is a need to investigate the influence factors and mechanism on the mental growth of the teenagers within two-child families, which is not found in the existing literature. At the same time, there is no relevant literature combining NLP Understanding Hierarchy Theory to carry out research in this field.

3. Data, Variables, and Methods

Based on the literature analysis, the research objective and questions become more clear, which laid a solid foundation for the questionnaire design. The main research object of this topic is the teenager group aged 12-18. In the process of a person's socialization, adolescence is a key period of socialization, and family is an important place for socialization. The change of family structure caused by the second child is bound to have an important influence on physical and mental development of teenagers. On the other hand, teenagers' views on the second child will also react on the implementation of the two-child policy. This study is mainly based on the data from the interviews and questionnaire survey.

3.1. Construction of Dependent Variable System of Teenagers' Mental Health Based on NLP Understanding Hierarchy Theory

Growth of teenagers includes many aspects such as study, life, family relations and psychological status. In order to make a systematic analysis of different aspects, this paper adopts the NLP (Neuro Linguistic Programming) Understanding Hierarchy Theory, which was reorganized by Robert Dilts in 1991 according to the logical hierarchy of learning and change proposed by the anthropologist Gregory Bateson^[19]. In this framework, the understanding level is composed of six independent hierarchical concepts, from low to high, which are environment, behavior, ability, belief & value, identity and spirit. In Figure 1, "Environment" refers to various influence factors other than people themselves, such as other people, things, time and culture. "Behavior" refers to all kinds of activities that people are engaged in the environment, such as learning, worrying and crying. "Ability" refers to the options, driving modes and control methods that people have in the current environment, that is, how people act. "Belief" refers to the standard or criterion used by people to judge people, things and objects, that is, the basis for people to make choices, and refers to people's beliefs or values. "Identity" refers to a person's role orientation in the environment and in the process of behavior, and his own iden-

tity to achieve the meaning of life. For example, a teenager wants to become an excellent student by studying hard. "Spirit" reflects the relationship between people and the world. It belongs to the level of world ideology. Not only the realization of self-worth should be considered, but also the altruism, such as family, relatives, children, friends and society. In NLP Understanding Hierarchy Model, the three concepts of "spirit, identity and belief" respectively correspond to the world view, outlook on life and values, and have a decisive influence on people's words and actions. They belong to high-level abstract concepts which are usually hidden. They can only be discovered by careful observation and analysis of people's daily life. "Ability, behavior and environment" are people's daily performance under the guidance of "Three Outlooks" (outlooks on the world, life and values). They belong to lower level concepts and are relatively easy to be observed. The interaction between levels of NLP Understanding Hierarchy is very close. The influence from high to low in the model is direct and rapid. The influence from low to high requires accumulation of quantity, which is relatively slow. Therefore, the NLP Understanding Hierarchy Model provides a general principle for diagnosing and correcting people's psychological and behavior deviations, that is, to seek solutions from a higher level and the possibility of auxiliary solutions from a lower level.

This study, combined with the NLP Understanding Hierarchy Model, designed the dependent variable system framework of the second child affecting the growth of teenagers, as shown in Table 1.

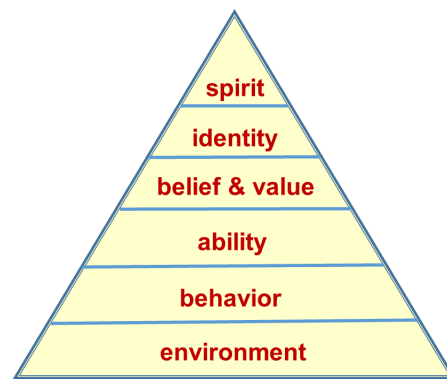


Figure 1. NLP understanding hierarchy model

3.2 Variables and Measurement Model

Let $y=f(x)$. In this equation, the independent variable is x and the dependent variable is y . Applying this equation to sociological research, the independent variable refers to the factors or conditions that researchers actively manipulate and cause the dependent variable to change. Therefore, the independent variable is regarded as the cause of

Table 1. The dependent variable system of teenagers' mental health based on NLP understanding hierarchy model

NLP understanding hierarchy	Dependent variable of teenagers' mental health	Examples of only child families	Examples of two-child families
spirit	psychological status	I think my growth is the most important thing in my family.	Now my younger sibling's growth is the most important thing in my family.
identity	family relations, psychological status	I am Mom and Dad's treasure. I think my family will support me to achieve my goals in life.	I am Mom and Dad's "No. 2 treasure". My family is distracted to care about the growth of my sibling.
belief & values	psychological status	I think my parents care much about me, and I have self-confidence.	My parents no longer care much about me. They are even partial to my younger sibling. My self-confidence decreased.
ability	study	I have solid basic knowledge and good capability to understand.	I don't have solid basic knowledge but good capability to understand.
behavior	study, life	My home environment is quiet and I will not be disturbed.	My younger sibling is noisy and my study is affected.
environment	life	I seldom do the housework.	My parents are busy, and I have to help to do the housework.

the dependent variable. In other words, the independent variable is the manipulated variable, while the dependent variable is the measured or recorded variable.

In addition, an experiment mainly involves three variables: independent variables, dependent variables and control variables. The independent variable refers to the variable operated and controlled by the experimenter. Dependent variable refers to the experimental response value of the subject's response to the operation of the independent variable. Control variable refers to potential factors or conditions that affect the experimental changes and results except the experimental variables in the experiment. In this study, the following variables are adopted to describe the econometric model.

3.2.1 Explained Variable (or Dependent Variable)

The explained variables in this topic include: study, life, psychological status and family member relationship.

Take the learning status of teenagers as an example: there are many reference points for it. For example, it can be set as dummy variables here. "1" means that the academic record increases after the birth of the second child. "0" means that the academic record decreases after the birth of the second child. Or we can directly use the academic record as the yardstick of learning status, for example, the total score of the last final exam can be used as the variable.

3.2.2 Explanatory Variable (or Independent Variable)

The explanatory variables in this study include four dimensions: gender, age difference, family economic status, parents' energy and attitude.

In the research, one of them can be used as an explanatory variable and the others as control variables. For example, if the gender of the second child is chosen as the explanatory variable, we can use the dummy variables as follows: "1" means that the gender of the second child is male, "0" means that the gender of the second child is female.

3.2.3 Control Variable

Control variable refers to all variables that affect the experimental results except experimental factors (independent variables). These variables are not the ones to be studied in this experiment, so they are also called irrelevant variables.

For example, if the purpose of study is to investigate "the influence of the gender of the second child on teenagers' learning status", we need to exclude the influence of other factors on teenagers' learning status, such as age difference and health status in personal characteristic variables, and parents' educational background, family economic status, parents' energy in family characteristic variables. Because these variables also affect the dependent variables to be studied, these variables need to be controlled. So, it is necessary to add these variables to the econometric model to control their influence on the dependent variables.

3.3 Econometric Modelling

In order to investigate the influence of the gender of the second child on teenagers' learning, the econometric model can be established as following:

$$study_i = \beta_0 + \beta_1 * gender_i + \beta_2 * X_i + \varepsilon_i \quad (1)$$

In Equation (1), $study_i$ refers to the learning status of the i^{th} investigated teenager. $gender_i$ refers to the dummy variable of the gender of the second child in the i^{th} investigated teenager's family. The dummy variable is the variable with 0 or 1 only. Here, "1" means that the gender of the second child is male, and "0" means that the gender of the second child is female. X_i refers to control variables, including personal characteristic variables (age difference) and family characteristic variables (family economic status, parents' energy and attitude). ε_i is the residual disturbance term.

Control variables and independent variables can be interchanged. Control variables and independent variables can also be interchanged. If what you want to study is not the influence of the gender of the second child on teenagers' learning status, but the influence of parents' energy on teenagers' learning status, then swap gender of the second child with parents' energy: parents' energy is the independent variable, and gender of the second child is added to the control variable. Then the econometric model would be changed into the following:

$$study_i = \beta_0 + \beta_1 * energy_i + \beta_2 * X_i + \varepsilon_i \quad (2)$$

In Equation (2), $study_i$ refers to the learning status of the i^{th} investigated teenager. $energy_i$ represents parents' energy and attitude in the i^{th} investigated teenager's family. X_i refers to control variables, including personal characteristic variables (gender, age difference) and family characteristic variables (i.e., family economic status). ε_i is the residual disturbance term.

3.4 Research Methods

3.4.1 Pre-survey Interview Method

In order to obtain specific survey results and design the questionnaire questions, we conducted a pilot in-depth interview with five middle-school students, which consist of three female students and two male students. The two-child relationship combination completely covers "elder brother-younger sister", "elder brother-younger brother", "elder sister-younger sister", "elder sister-younger brother" in this survey. According to 11 questions in this interview, we determined the explanatory variables of the study, analyzed the influence of the explanatory variables on the explained variables, and designed a questionnaire. The interview adopted the method of face-to-face communication.

3.4.2 Questionnaire Survey

In the form of questionnaire, we investigated various influences of the second child on the growth of the teenagers

(the first children). The questionnaires were done online. We edited the questionnaire and distributed it through an online survey platform called *sojump* on April 30, 2021. The data collection was finished by May 7, 2021. There are 33 questions in the questionnaire, which is divided into six parts, involving the basic information of the respondents (questions No.1, 2, 3, 4, 7, 8), family status (questions No.5, 6, 9, 10, 11, 12), learning (questions No.13, 14), life (question No. 15, 16, 17, 18, 19), relationship of family members (questions No.20, 21, 22), and psychological status (questions No.23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33). According to the number of children in the respondent's family, ranking at family and personal status, the questionnaire was designed with a skip logic to make the results more accurate. According to the Chinese *Middle School Students' Mental Health Scale* (MSSMHS, <https://www.wjx.cn/vj/OpPTuum.aspx>), the psychological status part of the questionnaire was designed to make its results more reliable.

3.4.3 Data Analysis Method

In this study, Python is used to invoke Pandas Library to clean and pre-process the collected questionnaire data. Then the processed data were visually analyzed through Matplotlib Library, and at the same time the descriptive statistical information was obtained. On this basis, the relevant conclusions on the influence of the second child on the growth of the teenagers were drawn by doing the regression analysis of data through Scikit-learn Library according to the hypothesis test results. Moreover, we also compared the only child in one-child families and the first-born teenager in two-child families through statistical t-test, and further discussed the influence factors and paths of the second child on the growth of the teenagers.

4. Results and Analysis

4.1 Interview Results and Analysis

Prior interviews were conducted with five interviewees from four aspects: life, psychological status, family member relations and learning. The interview outline and questions are shown in Table 2.

The interviews were conducted from four dimensions: life, psychological status, relationship between family members and study. In the following, the dimension of psychological status is given for illustration.

Interview question 1: When you have a conflict with the second child, can your parents rationally analyze the problem and solve it? Do they usually criticize you first or the second child? Will they be partial to one side?

Observation 1: From the five interviewees in the pilot

Table 2. Interview outline and questions

Questions	Research contents
1. Did your parents communicate with you before giving birth to the second child? Do you support them?	Communication between parents and the elder child, and the elder child's attitude
2. Will the second child disturb you when you are doing something? Will your study and life be greatly affected?	Influence on study and life
3. Do you think your family becomes more active after having the second child? Do you like such atmosphere?	Influence on relations between family members
4. After having the second child, are there any major adjustments in your family? (for example, have you changed your room?).	Influence on life
5. Do you think your parents have the energy to take care of two children (do they need help from the elderly or nanny)? Do you think you have any improvement in taking care of people?	Influence on parents' energy and the elder child's personality
6. When you have a conflict with the second child, can your parents rationally solve the problem? Will they be partial to one side?	Influence on parents' attitude and the elder child's psychological status
7. Did your younger brother/sister bring you anything that made you very happy?	Influence on family member relations
8. In addition to the above, what greater influence has the second child had on your life?	Influence on life
9. Are you getting along well with your younger brother/sister?	Influence on family member relations
10. Do you want to be the first child or the second one in your family if you can choose?	Compare with the opinions of the control group (the only child), investigate the attitude of the first child and the only child towards the second child
11. Do you want a younger brother or a younger sister if you can choose ?	Compare with the opinions of the control group (the only child), investigate the attitude of the first child and the only child towards the gender of the second child

interview, three people's parents can rationally analyze the problem when their children have conflicts, and won't be partial to either side. One person's parents will criticize the elder child first. One person's parents won't intervene in the conflict between their children. It is preliminarily judged that when the first child and the second child have conflicts, basically the parents can analyze the problem rationally and won't be partial to either side.

Interviewee A (elder brother and younger brother): No. They don't care.

Interviewee B (elder brother and younger sister): They can analyze the situation rationally, and won't be overly partial to my younger sister. They always stick to the issues, and won't criticize me because I am the elder brother.

Interviewee C (elder sister and younger sister): They always criticize me first, especially my grandparents. Their excuse is that my sister is still small.

Interviewee D (elder sister and younger brother): No. They are very fair.

Interviewee E (elder sister and younger brother): In this respect, my parents are quite rational. Most of the time, my younger brother annoyed me first, so they would criticize my younger brother and treat two children fairly.

Interview question 2: Do you think your parents have the energy to take care of two children? Do they need help

from the elderly or nanny? Do you think you have any improvement in taking care of people?

Observation 2: All of the five interviewees in the pilot interview thought that they didn't improve their ability to take care of people after the birth of the second child. Four of them help to take care of the younger siblings, and one doesn't do it. Secondly, two interviewees' parents have enough energy and didn't ask for help from the elderly or nanny after the second child was born. Three families asked for help from the elderly and nanny after the second child was born. It is preliminarily judged that most probably the first child will help take care of the second child after the second child was born, but the birth of the second child will not improve the ability of the elder child to take care of other people. The proportion of families that need help after the birth of the second child is slightly larger, and the parents whose first child is a sister are lack of energy. Such families need help.

Interviewee A (elder brother and younger brother): No elderly or nanny helps us. I can take care of my younger brother, but my ability to take care of other people hasn't been improved.

Interviewee B (elder brother and younger sister): Without a nanny or grandparents, my parents can still take care of us. Sometimes I take care of my younger sister. It

seems that I've not improved in taking care of other people.

Interviewee C (elder sister and younger sister): My parents are not hardworking. Usually my grandparents help with the housework, taking care of my younger sister, taking her to school and picking her up. Although I help take care of my younger sister, there is no improvement in taking care of other people. We have a part-time maid helping us.

Interviewee D (elder sister and younger brother): My mother resigned. Sometimes my grandmother comes to take care of my younger brother, nothing else. I don't take care of him, there is no improvement on my ability to take care of other people.

Interviewee E (elder sister and younger brother): Usually my parents are very busy. They can only accompany my younger brother when they come home from work in the evening. Usually my grandparents take turns to help take care of my younger brother. I will also help take care of my younger brother, but I feel that there is no improvement in taking care of other people.

4.2 Questionnaire Survey Results and Analysis

4.2.1 Descriptive Statistics

A total of 457 questionnaires were collected in this survey. By screening the questionnaires (only reserved the questionnaires of the respondents who is the only child and the first child in two-child families) and excluding the unreasonable answer options, 405 valid questionnaires were obtained, with an effective recovery rate of 88.6%. For the sample size, there are no clear statistical requirements. Usually, the sample size is about 5~10 times of the

topic. Therefore, it can be considered that the questionnaires used in this research are representative and valid.

In the valid questionnaires, 224 teenagers are the only children, accounting for 55.3%, and 181 teenagers are the first children in the two-child families, accounting for 44.7%. First of all, the growth of the first children in the two-child families was studied and analyzed. Among the gender of the first children, girls accounted for 73.66% and boys accounted for 26.34%. In contrast, among the gender of the second children, boys accounted for 62.98%, while girls accounted for 36.02% only. Furthermore, the samples of this study mainly come from Shanghai and surrounding areas, so the household income is relatively good. About 30% of the households have a monthly income of more than RMB20,000.

Based on NLP Understanding Hierarchy Theory, relevant dependent variables and independent variables are established for data analysis. We used Python to invoke Pandas Library to clean and pre-process the collected questionnaire data. Based on the processed data, 11 variables related to the research were obtained. The field names and meanings of the variables are shown in Table 3.

Then, we invoked the Matplotlib Library to visually analyze the data and got a series of descriptive statistical information. The correlation between the variables was obtained by calculation of the correlation coefficient matrix, as shown in Figure 2. It can be seen that the correlation coefficient between the independent variable of parents' attitude and the five dependent variables is relatively large. Furthermore, the correlation coefficient between the two dependent variables is also large (0.44), which are the relationship between teenagers and parents, and the psychological status of teenagers.

Table 3. Field names and meanings of the variables

Independent variable		Dependent variable	
field name	meaning	field name	meaning
gender1	gender of the first child	study	the study status of the teenagers(the first child)
age1	age of the first child	life	life status of the teenagers
gender2	gender of the second child	parents_relationship	the relationship between the teenagers and the parents
income	household income	child_relationship	Relationship between the first child and the second child
attitude	parents' attitude towards the first child and the second child	mental health	mental status of the teenagers
delta_age	age difference between the first child and the second child		

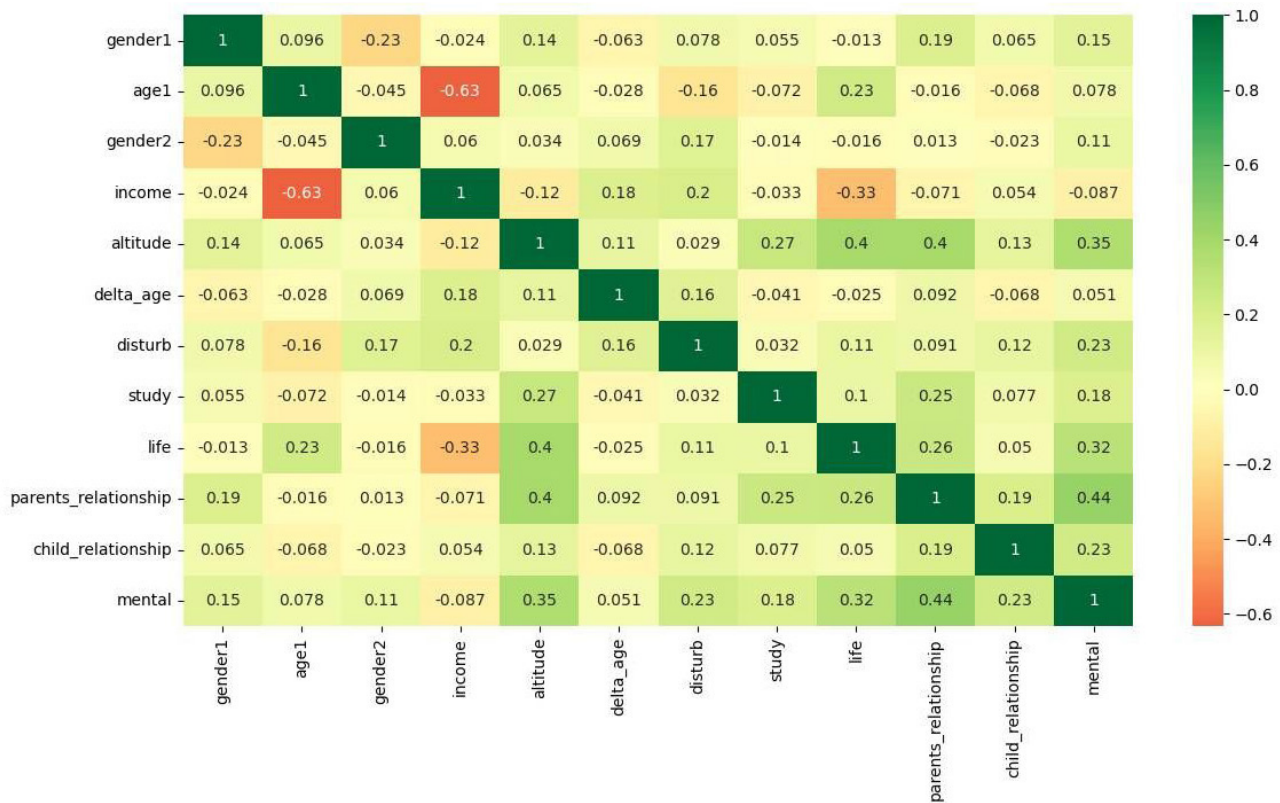


Figure 2. Thermodynamic diagram of correlation coefficient of the variables

4.2.2 Influence of the Second Child on the Study Status of the Teenagers

Before the quantitative analysis, firstly an exploratory analysis is conducted through the matrix diagram, as shown in Figure 3.

It can be seen that in the row of attitude, the blue and green lines are quite clear, which correspond to the increase and decrease of academic performance. It indicates that there is a certain relation between the parents' attitude and the teenagers' study status.

From the results of linear regression model (see Figure 4), we found that the influence of the second child on the teenagers' study status is mainly caused by the partial attitude of the parents after having the second child. According to the regression results, it can be seen that in the first

model, the influence of other variables is not significant except the attitude. While in the second model obtained by model selection, the coefficient of age1 is significantly negative at 10% degree of confidence, and the coefficient of attitude is still significantly positive.

This result showed that the parents' partiality to their second child will lead to the decline of their first child's academic performance. Furthermore, with the growing up of the first child, the influence of the parents' attitude on academic performance will gradually reduce. To our surprise, the disturbance from younger siblings to the first child does not really affect the academic performance of the first child, or such disturbance may need to be mediated by the emotional variables to have an influence. Later, we will verify this point in the influence of the second child on the teenagers' psychological status.

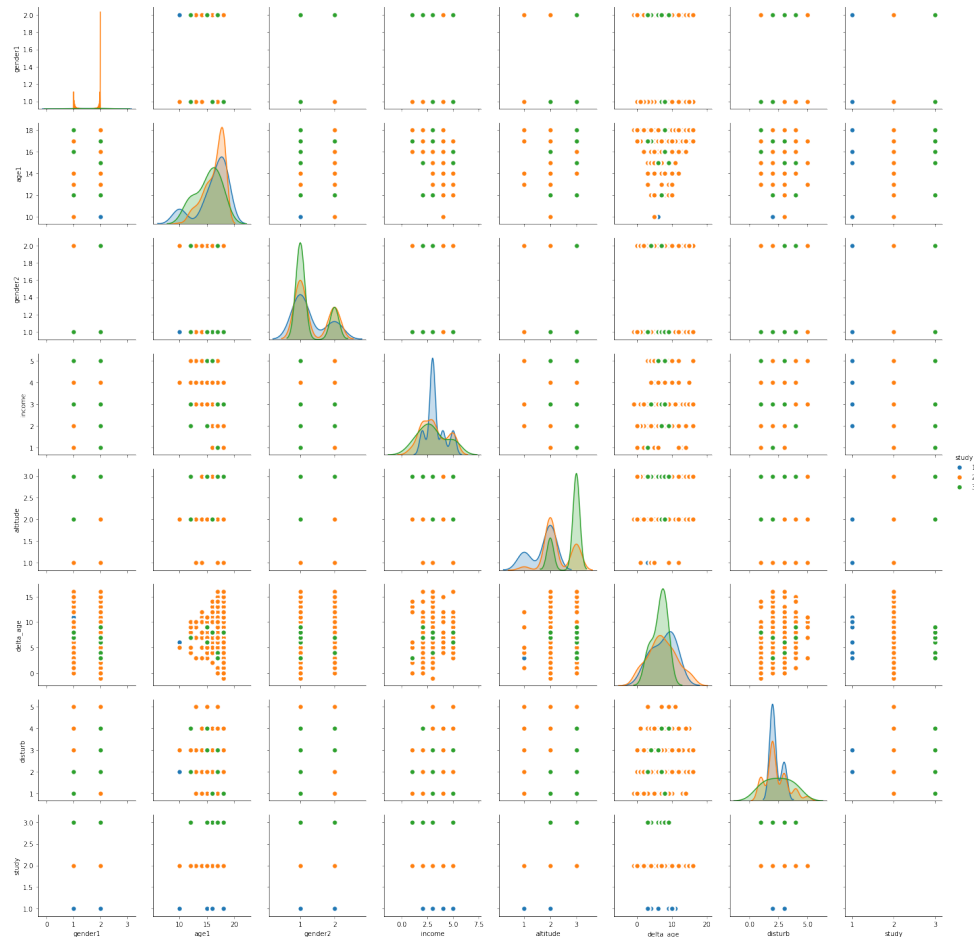


Figure 3. Matrix analysis on the teenagers' study

OLS Regression Results

Dep. Variable:	study	R-squared:	0.092			
Model:	OLS	Adj. R-squared:	0.056			
Method:	Least Squares	F-statistic:	2.517			
Date:	Sun, 16 May 2021	Prob (F-statistic):	0.0173			
Time:	21:00:13	Log-Likelihood:	-22.632			
No. Observations:	181	AIC:	61.26			
Df Residuals:	173	BIC:	86.85			
Df Model:	7					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	2.0982	0.305	6.872	0.000	1.496	2.701
gender1	0.0118	0.050	0.234	0.815	-0.088	0.111
age1	-0.0214	0.014	-1.513	0.132	-0.049	0.007
gender2	-0.0129	0.046	-0.282	0.778	-0.104	0.078
delta_age	-0.0045	0.006	-0.813	0.417	-0.016	0.006
income	-0.0203	0.023	-0.883	0.378	-0.066	0.025
altitude	0.1443	0.039	3.676	0.000	0.067	0.222
disturb	0.0090	0.022	0.406	0.685	-0.035	0.053
Omnibus:	37.504	Durbin-Watson:	1.896			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	434.513			
Skew:	0.085	Prob(JB):	4.43e-95			
Kurtosis:	10.589	Cond. No.	275.			

OLS Regression Results

Dep. Variable:	study	R-squared:	0.087			
Model:	OLS	Adj. R-squared:	0.072			
Method:	Least Squares	F-statistic:	5.639			
Date:	Sun, 16 May 2021	Prob (F-statistic):	0.00103			
Time:	21:01:11	Log-Likelihood:	-23.148			
No. Observations:	181	AIC:	54.30			
Df Residuals:	177	BIC:	67.09			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	2.1235	0.290	7.312	0.000	1.550	2.697
age1	-0.0226	0.014	-1.637	0.103	-0.050	0.005
income	-0.0232	0.022	-1.053	0.294	-0.067	0.020
altitude	0.1417	0.038	3.725	0.000	0.067	0.217
Omnibus:	37.609	Durbin-Watson:	1.916			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	440.847			
Skew:	0.071	Prob(JB):	1.87e-96			
Kurtosis:	10.644	Cond. No.	238.			

(1) the first model

(2) the second model

Figure 4. Linear regression results of the teenagers' study status

4.2.3 The Influence of the Second Child on the Teenagers' Life

In the similar manner, an exploratory analysis is conducted through matrix diagram, as shown in Figure 5.

From the results of linear regression model (see Figure 6), we found that the family income and the parents' attitude are the factors that affect the teenagers' life. This study investigated the influence of the birth of the second child on the teenagers' life from four aspects: room size, means of getting to school, school time and contribution to housework. It can be seen from the diagram below that family income has a significant negative influence on the

teenagers' life, while the parents' attitude has a significant positive influence on the teenagers' life. This indicates that the higher the family income, the less the influence of the birth of the second child on the teenagers' life. For example, the original family residential space is large. After the birth of the second child, the room size of the first child has not changed. If the family residential space is limited, the first child may have to share his/her own room with the second child. Furthermore, the parents' partiality attitude to the second child is also a major factor affecting the teenagers' life. The more the parents are partial to the second child, the greater the influence on the teenagers' life.

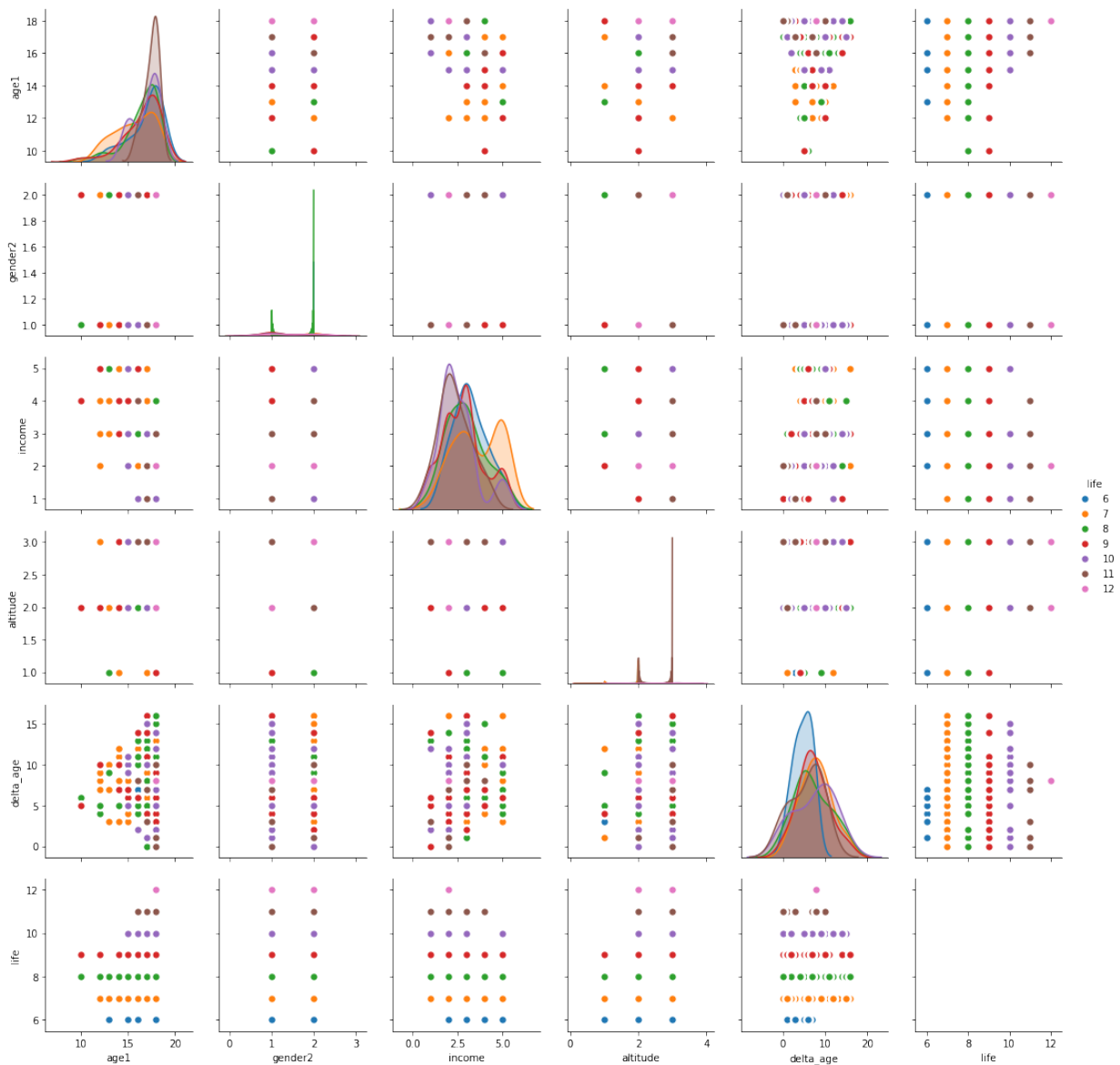


Figure 5. Matrix analysis on the teenagers' life

OLS Regression Results

Dep. Variable:	life		R-squared:	0.246		
Model:	OLS		Adj. R-squared:	0.220		
Method:	Least Squares		F-statistic:	9.484		
Date:	Sun, 16 May 2021		Prob (F-statistic):	5.20e-09		
Time:	21:03:40		Log-Likelihood:	-281.91		
No. Observations:	181		AIC:	577.8		
Df Residuals:	174		BIC:	600.2		
Df Model:	6					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	6.7985	1.268	5.360	0.000	4.295	9.302
gender1	-0.2567	0.208	-1.232	0.219	-0.668	0.154
age1	0.0383	0.059	0.649	0.517	-0.078	0.155
gender2	-0.0830	0.189	-0.440	0.661	-0.456	0.290
delta_age	-0.0083	0.023	-0.360	0.719	-0.054	0.037
income	-0.2641	0.096	-2.764	0.006	-0.453	-0.076
altitude	0.9221	0.164	5.622	0.000	0.598	1.246
Omnibus:	6.758	Durbin-Watson:	1.779			
Prob(Omnibus):	0.034	Jarque-Bera (JB):	7.007			
Skew:	0.474	Prob(JB):	0.0301			
Kurtosis:	2.829	Cond. No.	272.			

(1) the first model

OLS Regression Results

Dep. Variable:	life		R-squared:	0.243
Model:	OLS		Adj. R-squared:	0.231
Method:	Least Squares		F-statistic:	18.98
Date:	Sun, 16 May 2021		Prob (F-statistic):	1.02e-10
Time:	21:04:10		Log-Likelihood:	-282.28
No. Observations:	181		AIC:	572.6
Df Residuals:	177		BIC:	585.3
Df Model:	3			
Covariance Type:	nonrobust			

	coef	std err	t	P> t	[0.025	0.975]
Intercept	7.3584	0.545	13.513	0.000	6.284	8.433
gender1	-0.2153	0.199	-1.081	0.281	-0.608	0.178
income	-0.3098	0.071	-4.339	0.000	-0.451	-0.169
altitude	0.9053	0.161	5.634	0.000	0.588	1.222

Omnibus:	6.930	Durbin-Watson:	1.771
Prob(Omnibus):	0.031	Jarque-Bera (JB):	7.198
Skew:	0.481	Prob(JB):	0.0274
Kurtosis:	2.827	Cond. No.	29.1

(2) the second model

Figure 6. Linear regression results of the teenagers' life

4.2.4 The Influence of the Second Child on the Parent-Child Relationship of the Teenagers

Similarly, an exploratory analysis for the relationship between the teenagers and parents is conducted through matrix diagram, as shown in Figure 7.

From the results of the linear regression model (see Figure 8), we found that the gender of the first child and the parents' attitude are the factors that affect the parent-child relationship of the teenagers. Both factors have significant positive influences. We measure the relationship between the parents and the children by the changes in personal feelings and parental relations after the birth of the second child and the times of heart to heart talks with parents. The results showed that if the first child is a girl, the heart-to-heart talks with her parents will be less, and the relationship with her parents will be more distant. The possible explanation here is that comparing with boys, girls will be closer to their parents normally. It is also related to the traditional Chinese concept of family education. Furthermore, comparing with boys, girls' minds are more sensitive, so they can also feel the differences before and after the birth of the second child, a sense of gap coming into being. Therefore, the gender of the first child has

a more significant influence on the parent-child relationship.

4.2.5 The Influence of the Second Child on the Relationship between the Children

Similarly, an exploratory analysis for the relationship between the children is conducted through matrix diagram, as shown in Figure 9.

From the results of the linear regression model (see Figure 10), we found that the regression results in the lower right diagram showed that the age difference has a negative significant influence on the relationship between the children, while parental attitude has a positive significant influence. It showed that the partiality of the parents will affect the harmony between the children. The larger the age difference is, the more harmonious relationship between the children will be.

Because when the age difference of the children is large, their respective needs differ greatly, and there are relatively few contradictions. In addition, when the age difference is extra large, some of the first children will have the mentality of "little parent" to take care of the second child. Thus it will deepen the relationship between the two children.

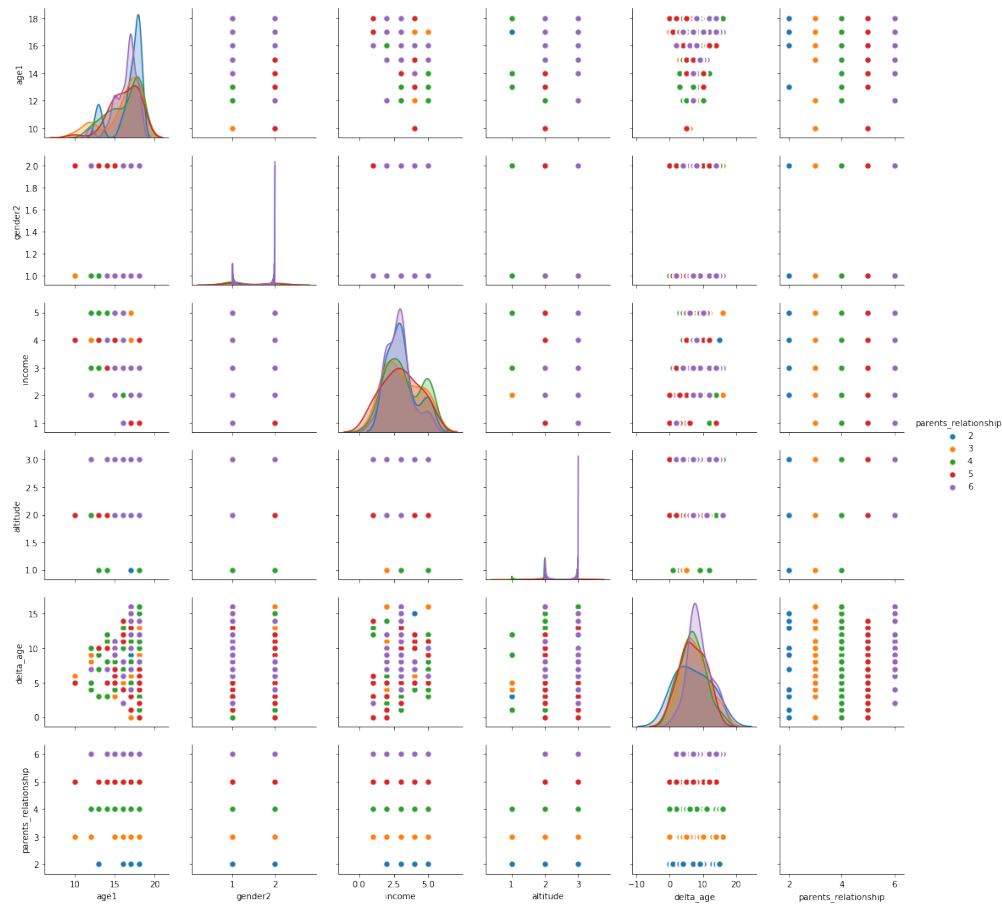


Figure 7. Matrix analysis on the relationship between the teenagers and parents

OLS Regression Results

Dep. Variable:	parents_relationship	R-squared:	0.11			
Model:	OLS	Adj. R-squared:	0.10			
Method:	Least Squares	F-statistic:	6.90			
Date:	Sun, 16 May 2021	Prob (F-statistic):	1.18e-04			
Time:	21:06:47	Log-Likelihood:	-249.0			
No. Observations:	181	AIC:	513.0			
Df Residuals:	174	BIC:	536.0			
Df Model:	6					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	3.1155	1.062	2.933	0.004	1.019	5.212
gender1	0.3936	0.174	2.257	0.025	0.049	0.738
age1	-0.0715	0.049	-1.448	0.149	-0.169	0.026
gender2	0.0762	0.158	0.482	0.630	-0.236	0.388
delta_age	0.0214	0.019	1.111	0.268	-0.017	0.059
income	-0.1079	0.080	-1.349	0.179	-0.266	0.050
altitude	0.7088	0.137	5.161	0.000	0.438	0.980
Omnibus:	2.041	Durbin-Watson:	2.206			
Prob(Omnibus):	0.360	Jarque-Bera (JB):	1.929			
Skew:	-0.168	Prob(JB):	0.381			
Kurtosis:	2.623	Cond. No.	272.			

OLS Regression Results

Dep. Variable:	parents_relationship	R-squared:	0.178			
Model:	OLS	Adj. R-squared:	0.169			
Method:	Least Squares	F-statistic:	19.30			
Date:	Sun, 16 May 2021	Prob (F-statistic):	2.59e-08			
Time:	21:07:09	Log-Likelihood:	-251.51			
No. Observations:	181	AIC:	509.0			
Df Residuals:	178	BIC:	518.6			
Df Model:	2					
Covariance Type:	nonrobust					
	coef	std err	t	P> t 	[0.025	0.975]
Intercept	1.8930	0.399	4.743	0.000	1.105	2.680
gender1	0.3329	0.168	1.986	0.049	0.002	0.664
altitude	0.7464	0.134	5.557	0.000	0.481	1.011
Omnibus:	1.913	Durbin-Watson:	2.208			
Prob(Omnibus):	0.384	Jarque-Bera (JB):	1.749			
Skew:	-0.137	Prob(JB):	0.417			
Kurtosis:	2.604	Cond. No.	17.9			

(1) the first model

(2) the second model

Figure 8. Linear regression results of the relationship between the teenagers and the parents

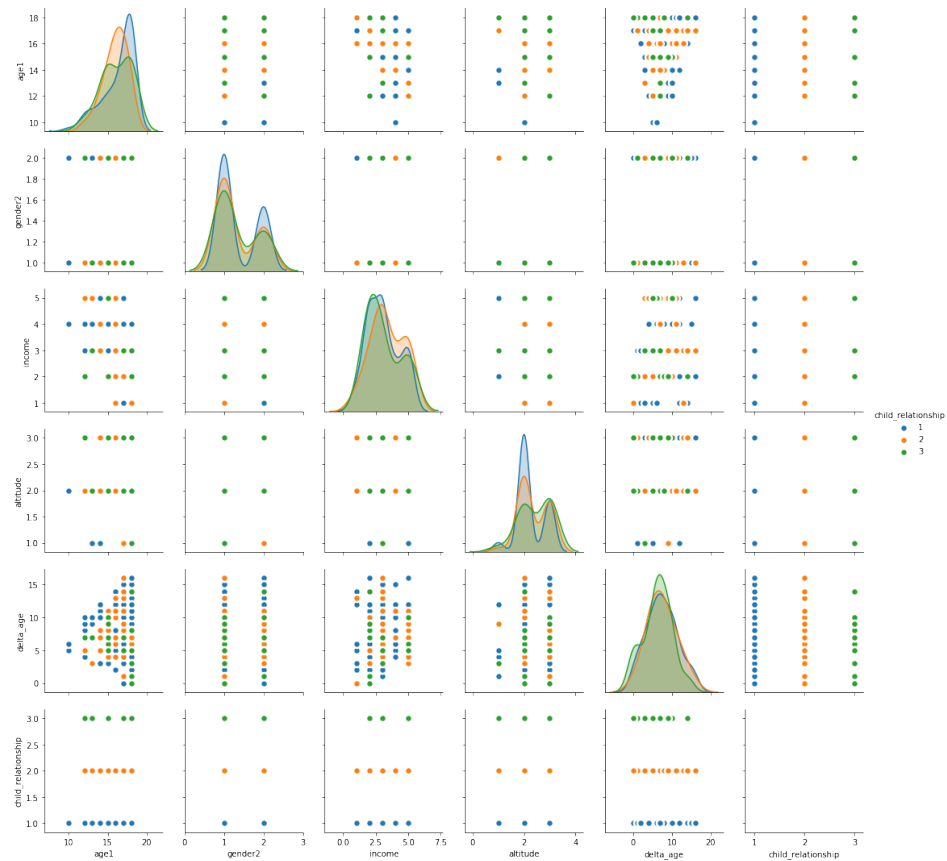


Figure 9. Matrix analysis on the relationship between the teenagers and the second child

OLS Regression Results

Dep. Variable:	child_relationship	R-squared:	0.031
Model:	OLS	Adj. R-squared:	0.002
Method:	Least Squares	F-statistic:	1.041
Date:	Sun, 16 May 2021	Prob (F-statistic):	0.397
Time:	21:09:29	Log-Likelihood:	-177.61
No. Observations:	181	AIC:	369.9
Df Residuals:	174	BIC:	391.1
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
Intercept	1.1658	0.713	1.635	0.104	-0.242	2.573
gender1	0.0614	0.117	0.524	0.601	-0.170	0.292
age1	-0.0157	0.033	-0.473	0.637	-0.081	0.050
gender2	-0.0251	0.106	-0.236	0.813	-0.235	0.184
delta_age	-0.0155	0.013	-1.197	0.233	-0.041	0.010
income	0.0327	0.054	0.609	0.543	-0.073	0.139
altitude	0.1749	0.092	1.898	0.059	-0.007	0.357

Omnibus:	47.612	Durbin-Watson:	2.038
Prob(Omnibus):	0.000	Jarque-Bera (JB):	75.678
Skew:	1.496	Prob(JB):	3.69e-17
Kurtosis:	4.039	Cond. No.	272.

(1) the first model

OLS Regression Results

Dep. Variable:	child_relationship	R-squared:	0.032
Model:	OLS	Adj. R-squared:	0.015
Method:	Least Squares	F-statistic:	1.926
Date:	Sun, 16 May 2021	Prob (F-statistic):	0.127
Time:	21:09:50	Log-Likelihood:	-177.97
No. Observations:	181	AIC:	363.9
Df Residuals:	177	BIC:	376.7
Df Model:	3		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
Intercept	0.9268	0.259	3.577	0.000	0.416	1.438
delta_age	-0.0169	0.013	-1.333	0.184	-0.042	0.008
income	0.0486	0.041	1.187	0.237	-0.032	0.129
altitude	0.1827	0.090	2.023	0.045	0.005	0.361

Omnibus:	47.110	Durbin-Watson:	2.035
Prob(Omnibus):	0.000	Jarque-Bera (JB):	74.502
Skew:	1.492	Prob(JB):	6.64e-17
Kurtosis:	3.990	Cond. No.	50.6

(2) the second model

Figure 10. Linear regression results of the relationship between the teenagers and the second child

4.2.6 The Influence of the Second Child on the Teenagers' Mental Status

In the similar manner, an exploratory analysis for the influence of the second child on the teenagers' mental status is conducted through matrix diagram, as shown in Figure 11.

With reference to Chinese *Middle School Students' Mental Health Scale*, we evaluated the mental status of the teenagers from five aspects. From the linear regression results in Figure 12, it can be seen that the gender of the teenagers (the first child), the gender of the second child and the parents' attitude will have a positive and significant influence on the teenagers' mental status. The

parents' partiality to the second child will stimulate the psychology of the first child to a certain extent, resulting in a sense of imbalance and depression, thus to affect the psychology of the teenagers. However, different from the cognition that women's mental health is better than men's in general studies, if the first child is a girl, the influence on her mental status will be stronger. For this reason, the possible explanation is that although girls' mental status is better, they are also more vulnerable to the interference of the external environment, and the fluctuation of their mental status is greater than that of boys. In addition, if the second child is a girl, the influence on the mental status of the teenagers is greater than that if the second child is a boy.



Figure 11. Matrix analysis on the teenagers' mental status

OLS Regression Results

Dep. Variable:	mental	R-squared:	0.153			
Model:	OLS	Adj. R-squared:	0.124			
Method:	Least Squares	F-statistic:	5.250			
Date:	Sun, 16 May 2021	Prob (F-statistic):	5.39e-05			
Time:	21:13:46	Log-Likelihood:	-311.58			
No. Observations:	181	AIC:	637.2			
Df Residuals:	174	BIC:	659.5			
Df Model:	6					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	4.5998	1.494	3.078	0.002	1.651	7.549
gender1	0.4509	0.245	1.838	0.068	-0.033	0.935
age1	0.0172	0.069	0.247	0.805	-0.120	0.154
gender2	0.3968	0.222	1.784	0.076	-0.042	0.836
delta_age	0.0092	0.027	0.339	0.735	-0.044	0.063
income	-0.0535	0.113	-0.475	0.635	-0.276	0.169
altitude	0.8590	0.193	4.446	0.000	0.478	1.240
Omnibus:	1.833	Durbin-Watson:	2.221			
Prob(Omnibus):	0.400	Jarque-Bera (JB):	1.434			
Skew:	-0.153	Prob(JB):	0.488			
Kurtosis:	3.310	Cond. No.	272.			

(1) the first model

OLS Regression Results

Dep. Variable:	mental	R-squared:	0.149			
Model:	OLS	Adj. R-squared:	0.135			
Method:	Least Squares	F-statistic:	10.37			
Date:	Sun, 16 May 2021	Prob (F-statistic):	2.55e-06			
Time:	21:14:13	Log-Likelihood:	-311.99			
No. Observations:	181	AIC:	632.0			
Df Residuals:	177	BIC:	644.8			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	4.7333	0.669	7.079	0.000	3.414	6.053
gender1	0.4504	0.242	1.865	0.064	-0.026	0.927
gender2	0.3895	0.220	1.768	0.079	-0.045	0.824
altitude	0.8843	0.189	4.690	0.000	0.512	1.256
Omnibus:	1.352	Durbin-Watson:	2.206			
Prob(Omnibus):	0.509	Jarque-Bera (JB):	0.977			
Skew:	-0.106	Prob(JB):	0.614			
Kurtosis:	3.291	Cond. No.	23.2			

(2) the second model

Figure 12. Linear regression results of the teenagers' mental status

In order to verify the results, we invoked the T-test in the Stats Library to compare the mental status of the first child in the two-child family with that of the only child. It can be seen that the statistical value is 3.513 and the P-value is far less than 0.01 (see Table 4). Therefore, it can be considered that the value of the mental status of the first child is larger than that of the only child, that is, the mental status of the only child is generally better than that of the first child. It also showed that the birth of the second child has a significant influence on the mental status of the teenagers.

Table 4. T-test results

statistic	3.5127248995656495
p value	0.0004937641027899569

Furthermore, we invoked the Statsmodels Library and used the method of Logistic Regression to compare the mental status of the first child and the only child from five aspects (social willingness, solutions to difficulties, parental care, self-confidence, and the way to face the negative emotions). From the linear regression results in Figure 13, it can be seen that the situation of the first child is significantly different from that of the only child in four aspects: social willingness, parental care, self-confidence and the way to face negative emotions.

Generalized Linear Model Regression Results

Dep. Variable:	twochild	No. Observations:	405
Model:	GLM	Df Residuals:	399
Model Family:	Binomial	Df Model:	5
Link Function:	logit	Scale:	1.0000
Method:	IRLS	Log-Likelihood:	-259.31
Date:	Sun, 16 May 2021	Deviance:	518.61
Time:	21:25:09	Pearson chi2:	404.
No. Iterations:	4		
Covariance Type:	nonrobust		

	coef	std err	z	P> z	[0.025	0.975]
const	-2.0741	0.493	-4.211	0.000	-3.039	-1.109
W	0.4192	0.272	1.540	0.123	-0.114	0.953
Y	0.1799	0.150	1.200	0.230	-0.114	0.474
Z	0.7461	0.204	3.657	0.000	0.346	1.146
AD	-0.4804	0.144	-3.347	0.001	-0.762	-0.199
AF	0.3807	0.117	3.245	0.001	0.151	0.611

Figure 13. Logistic regression on comparison of the mental status of the first child and the only child

5. Conclusions

Based on the NLP Hierarchy Theory, this study determined the dependent variables of the teenagers' mental health affected by the second child. The main explanatory variables of the teenagers' mental health affected by the second child were determined in terms of the in-depth interviews. Then, a questionnaire for empirical research was designed according to Chinese Middle School Students' Mental Health Scale. Econometric model and Python programming were used to analyze the data. The following conclusions are reached.

5.1 The Influence of the Second Child on the Teenagers' Study

Among all the factors, the parents' attitude has the most significant influence on the teenagers' study status. The parents' partiality will lead to the decline of the first child's academic performance. The elder the first child is, the less influence it will have on his/her study. At the same time, contrary to the guess, the noise problem from the second child about which people are concerned will not have a direct influence on the first child's academic performance, but it will have an influence by affecting the first child's emotion.

5.2 The Influence of the Second Child on the Teenagers' Life

The family economic status and the parents' attitude are the main factors affecting the teenagers' life. Among them, the higher the family income, the less the influence on the first child's life; The greater the change of the parents' attitude, the greater the influence on the first child's life. After having the second child, the first child needs to undertake more housework.

5.3 The Influence of the Second Child on the Teenagers' Family Member Relationship

5.3.1 The Influence on the Parent-Child Relationship

The gender of the first child and the parents' attitude have the most significant influence on the relationship between the first child and his/her parents. Usually girls have more heart to heart talks and exchanges with their parents. They are more likely to feel the changes in their relationship with their parents after having the second child. So they tend to be estranged with their parents.

5.3.2 The Influence on Sibling Relationship

Age difference and the parents' attitude have the greatest influence on the sibling relationship between the two children. Surprisingly, the greater the age difference, the less the influence of the second child on the relationship between the first child and second child. This is mainly because there is a competitive relationship between the children with similar age. They are more prone to contradictions and frictions. For the children with larger age difference, the first child and the second child have different needs. It is not easy for them to have contradictions. And most of the first children are sensible enough to take the initiative to take care of the second child, so they get along better. The greater the difference in parents' attitude towards the two children, the greater the negative influence on the sibling relationship.

5.4 The Influence of the Second Child on the Teenagers' Mental Status

The gender of the first child, the gender of the second child and the parents' attitude will have a significant influence on the teenagers' mental status. Different from the cognition that women's mental health is better than men's in general studies, if the first child is a girl, the influence on her mental status will be stronger. It's mainly because girls' mental status is better, but they are also more vulnerable to the interference of the external environment. And the fluctuation of their mental status is greater than that of boys. In addition, if the second child is a girl, the influence on the mental status of the teenagers is greater than that if the second child is a boy. Usually people would think that the younger brother is noisier, and have greater influence on the first child. Due to the reduction of the parents' concern and the change of their attitude, comparing with the only child, the first child in the two-child families are less sociable, and more likely to feel insecure. They feel stressed and irritable more often, especially girls.

5.5 The Depth of the Influence of the Second Child on the Growth of Teenagers

According to the NLP Hierarchy Theory, this study concluded that the second child has a more in-depth influence on the growth of the teenagers. Human logic was divided into six levels by NLP Hierarchy Theory. Among them, the second child has a significant influence on the environment at the bottom and the behavior at the sub-bottom, but has little influence on the ability at the

third level and the beliefs and values at the fourth level. The first child's identity cognition is affected, while the deepest spirit is not easily affected. In other words, the second child has a great influence on the first child's daily life, behavior and family identity, but his/her ability and three outlooks (world view, outlook on life and value) are not easily affected.

6. Discussion and Suggestions

6.1 Limitations

A total of 407 valid questionnaires were collected in this research, including 182 questionnaires from the two-child families, which were distributed through the questionnaire platform *sojump*. The questions in the questionnaire were strictly designed and the response time was predicted. The collected data were processed and analyzed by scientific research methods, and conclusions were drawn. Therefore, this research results are scientific and effective, and constructive suggestions can be put forward for the growth of the first child in the two-child families. However, this research still has the following limitations.

6.1.1 Limitations of the Research Variables

Referring to the prior interviews, four explained variables in this study are "study", "life", "psychology" and "family member relationship", and four explanatory variables are "gender", "age difference", "family economic status" and "parental energy and attitude". When reviewing previous research reports and relevant literature in advance, we found that many aspects in the growth of the teenagers were affected. But due to the limit of time and survey scope, the above eight representative research variables were retained for research after discussion and consideration.

6.1.2 Simplified Two-child Family Structures

This study is only aimed at the simplified two-child family structures in which both parents raise families. The family environment is different from individual to individual. This study did not consider the complex family environment, but only investigated the families raised parents. Complex family structures include divorced families, families of left-behind children, families with both parents dead or one party dead, etc. The results of this paper are not applicable to the above special families with complex family structures.

6.1.3 Some Future Research Directions

Based on above research limitations, we put forward

the following suggestions for the research and related topics on the influence on the growth of the teenagers in the two-child families in the future.

1) Expansion of the research variables

Besides the eight variables investigated in this research: "study", "life", "psychology", "family member relationship", "gender", "age difference", "family economic status", "parental energy and attitude", future research can also explore the influence mechanism of the "second child" on the growth of the teenagers from other factors, such as whether the birth of the second child will cause more serious rebellious behavior of the first child during adolescence.

2) Discussion of different family types

Different family types, including divorced families, rural families with left-behind children, families with both parents dead or one party dead, poor families or wealthy families, can be explored and compared in groups, such as the difference in the influence of the parents' energy or family economic status on the children's psychological status. Or, a new econometric model can be established to specifically study the influence on the growth of the first child in such families.

6.2 Suggestions

At present, in order to cope with the severe problem of population aging in China, China relaxed the fertility conditions and implemented a universal two-child policy in 2016. Provinces and cities successively introduced policies to encourage fertility. With the deepening of population aging and the disappearance of demographic dividend, the burden on families and the society has been greatly increased. It has been more than five years since the implementation of the two-child policy. A significant number of families have changed from three people to four people. Considering that the only children will face the social responsibility and the economic pressure to support the elderly in the future, many parents respond to the national policy to have a second child. However, as the society pays more attention to the family education, more and more parents begin to consider the impact and influence of having a second child on the first child. They worry about whether they can treat two children of different ages equally in family education, and worry about whether having a second child will affect the healthy growth of the first child^[20]. At the same time, compared with the one-child family environment, there are influences of the siblings on the two-child family environment. Changes in family structures may affect the children's mental health.

According to the conclusion of this study, this paper aims to provide guidance for the first child in the two-

child families to grow better. The following constructive suggestions are given.

6.2.1 Advice for Parents with Two Children

(a) After the second child was born, the parents should treat any children equally, pay attention to the first child's daily emotions and behaviors, and correctly guide the first child to adapt to the change of family identity as soon as possible.

(b) Care more for the first child in daily life. Communicate with the first child at irregular intervals, or arrange parent-child activities that only the first child participates in. The parents whose first child is a girl need to pay special attention to their children's psychological status, such as social willingness, self-confidence, and ways to face negative emotions.

(c) The parents whose two children are with small age gap should pay attention to the sibling relationship of their children. When the children have disputes and contradictions, the parents should rationally analyze the problem, correctly guide them, and help them solve the problem. The parents whose two children are with large age gap should also make rational analysis, not just blame, and should appropriately guide the elder children to help take care of the younger siblings. While the elder child gets a sense of achievement, the feelings between the two children can also be enhanced.

6.2.2 Advice on Parents Who Plan to Have a Second Child

(a) Ask your child for his/her opinions before deciding to have a second child, and communicate with him/her patiently.

(b) Some factors such as the family economic situation and the parents' energy should be considered comprehensively, so as to avoid the negative influence on the first child in all aspects after the birth of the second child.

(c) Abandon the idea of "son preference". Some parents whose first child is a girl want to give birth to a son as the second child. If the first child is a girl, the psychological negative influence on her is obvious. The parents should consider having a second child carefully.

6.2.3 Suggestions for the Parents Who Have No Intention of Having a Second Child

(a) Always pay attention to the children's daily emotions and behaviors. As there are no siblings in the family, the only child will probably be a little overbearing in personality.

(b) Correctly guide the children to learn to share and to

be considerate.

Conflict of Interest

There is no conflict of interest.

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ARTICLE

Between the Craft and the Mud: An Analysis of the Work and Health Relationship of Firefighters in the Breach of the Córrego do Feijão Dam—Brumadinho/MG

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Abstract: Faced with the rupture of the Vale S.A. tailings dam that hit the city of Brumadinho (MG), the article sought to better understand the organisation of work of military firefighters who participated in the search and rescue operation and the relationship between work and health present in this scenario. This is qualitative research with a focus on the subjective production of the speeches of seven firefighters who were interviewed individually with a semi-structured script, using as a basis of analysis the ergological perspective and the productions of the psychodynamics of work. The firefighters experienced a scenario with risks of injury, contamination, and even death. In the interviews, they showed that the more than twelve hours of work were responsible for sleep problems during and after the performance, as well as the food provided and the lack of time for physical exercise proved to be aggravating factors for their health. Working in the tailing's mud combined the development of musculoskeletal problems and anxiety, due to the possibility of contamination by metals present in the mud. The work relationships show a high degree of trust and recognition between the firefighters and the affected population, which helped in the motivation and continuation of the operation until the present moment. The work in this operation that gained national prominence was responsible for the feeling of pride and for feeling more capable and prepared to act in other disasters. This research is expected to broaden the discussion about the work-health relationship of military firefighters exposed to disasters, as well as serve as a subsidy to encourage the creation of public policies focused on the health of these workers.

Keywords: Brumadinho; Firefighters; Disasters; Ergology; Rescue Work; Occupational Health

1. Introduction

Over the years there is a considerable increase in disasters causing deaths, damage to the environment, and de-

struction of both the public and private sectors. According to the report 'The Human Cost of Disasters 2000-2019' by the UN Office of Risk and Disaster Reduction, disasters of natural origin have doubled in the last twenty years ^[1].

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In this way, the dangers of the development model that aims to extract natural resources without limits, mark a lifetime of future uncertainties that threaten a multitude of people around the world. These threats are aggravated depending on the degree of vulnerability in which each individual finds himself.

This life of future uncertainties, unfortunately, became a reality on 25 January, 2019 in Brazilian history, mainly, in the lives of the citizens of the municipality of Brumadinho due to the rupture of dam B1 in the district of Córrego do Feijão. The dam, managed by the company VALE S.A., dumped about 12 million cubic metres of mining tailings that hit homes, cars, trees, rivers, and animals, leaving 272 people dead and more than 24,000 directly affected ^[2].

The collapse was considered an industrial, humanitarian and environmental disaster, and also the biggest workplace accident in Brazil. Near the dam that broke, administrative buildings and operational areas full of employees were affected by the tailings. One of the first buildings to be destroyed was the company restaurant, where—due to the time of the rupture (12:28:20 am)—contained many employees. The safety sirens, which should have alerted the population and the workers, were not activated ^[2].

Immediately after the dam rupture, the mining company was fined R\$250 million by the Brazilian Institute for the Environment and Renewable Natural Resources (Ibama). With this fine, the company totals the amount of R\$350.7 million in fines added to those of the rupture of the Fundão dam of the Samarco company (also managed by VALE S.A.) that affected districts of the municipality of Mariana in 2015 considered the country's greatest environmental tragedy that contaminated the Rio Doce and its tributaries and killed 19 people. Ibama claims that the fines stem from 25 open lawsuits and the mining company appealed all of them.

Despite the constant occurrence of these disasters and the various warnings from different entities about the need to improve inspections and dam safety, the Dam Safety Report ^[3] warns that, since the collapse of the VALE S.A. dam that hit Brumadinho, the inspections carried out at dam sites in Brazil have fallen by more than 90%. This data goes against any and all disaster risk prevention policies and reinforces the finding that lessons have not been learned by the Brazilian State and mining companies.

In these extreme situations, and due to the conditions in which the enterprise was carried out, without any inclusion of the internal and surrounding populations, in its economic planning of overexploitation of minerals, the health sector and Civil Defence receive a great increase in immediate demand, with firefighters and other rescue professionals moving all over the nation and must also be considered affected by the disaster process. Workers who

leave their families, their cities, and their routines to work in remote places, with ad-hoc timing and without basic infrastructure to support and receive them.

At the beginning of the operation in Brumadinho, military firefighters, a category of worker in disasters that stands out for their performance in search and rescue, had an exhausting work routine, with days exceeding fourteen hours of work, contamination with metals in the mud, poor quality of food and sleep, besides the impossibility of physical preparation before arriving ^[4].

In the social imagination, the firefighter is considered a hero, due to their hard work and dedication to save lives. However, the reality of their daily work presents demands like any other activity, which are intensified by the exposure to different risk situations, work pace, added to the rigidity of military discipline that often presents itself as an obstacle to making decisions that require quick answers. Due to the vision of heroes created by society for military firefighters, there is a tendency to think that these workers only have the mission of caring, not discussing their needs and whose health can be compromised and in need of attention ^[5]. In emergency and disaster scenarios, all health risks are amplified and, therefore, greater attention should be directed to the victims, but also to the exposed professionals.

With regards to the health of emergency and disaster workers, the focus on the work-health relationship of firefighters has been rarely discussed in academia and in national literature as a whole. Among these studies, many only focus on pathological indicators and/or physical consequences and few focus on the work activity ^[5]. This scenario points to the need for research that follows this bias, in the search for understanding the work processes in disasters, based on the perspective of workers.

This research is anchored in Worker's Health, seeking to understand the work-health relationship of firefighters in the Brumadinho operation. From the reports of these professionals, it sought to describe the process and organisation of work; identify possible health risks and the defensive strategies used by them.

2. Work-health Relationship

The field of Occupational Health is the result of a patrimony accumulated in the scope of Collective Health, with roots in the Latin American Social Medicine movement and influenced by the Italian Workers Movement. In this way, Worker's Health, unlike Occupational Medicine and Occupational Health, prioritizes the analysis of the work process and its relationship with the health-disease process, breaking with the hegemonic conceptions, uni or multicausal, that disregard the social and historical dimension of work in the relationship with health/disease. The subjective experience of the workers and their participation in the anal-

ysis/intervention as subjects of their health is prioritized, relativizing the hegemony of quantitative methods for the association of cause and effect. Therefore, it is necessary the integration of different disciplines to understand the dynamics between individual and collective subjects and their relationship with the health-disease process^[6, 7].

Work clinics^[8] have presented themselves as an important ally for the analysis of the work process and its relationship with health, from the activity approach. In this case, the concept of activity originates in ergonomics in French-speaking countries, coining the concepts of prescribed work (task) and the real work (activity). Therefore, for the analysis of the speeches given by these workers, as a basis we took the ergological perspective to understand the activity highlighting the production of Psychodynamics of Work (PDT) with regard to defensive strategies and recognition of the work.

The ergological perspective is an analysis tool proposed by the French philosopher Yves Schwartz that focuses on the activity point of view. For Schwartz (2000), activity always has—on the one hand—its describable character as protocols and norms to be followed, and on the other hand, the experiences themselves and their encounters and challenges of realisation^[9].

Thus, all productive activity can be approached in two ways: First we consider the task, defined previously, where the worker must put it into practice (alone or with his or her colleagues) in such a way that intellectual activities are developed with the intention of producing effective results; and the second perspective is how the work situation is dealt with, first of all, as a moment of life, what the worker is experiencing at that moment and the changes pertinent to their life, both personal and professional.

To treat the work situation as a moment of life requires a continuous and permanent learning of work situations, of the debates of norms that circulate the spaces of know-how and of values that indefinitely renew the activity in order to promote situated changes. In this way Ergology is presented as “[...] a project of better knowing and, above all, of better intervening on work situations to transform them” (p. 31)^[10].

Therefore, to comprehend someone’s work activity, according to Duraffourg (2021), it is necessary to promote an empathic attitude and a positive look toward the worker who is inserted in this universe of work (a universe of relationships and norms). This empathic attitude must occur at the detriment of the obsession with problems and their solutions that, many times, lead to decisions that are only remedial and pathologizing^[11].

In order for the analysis of the work-health relationship not to have a pathologizing character, Canguilhem (2009) states that something can only be conceptualised as sick

when the body as a whole is considered and, mainly, when the individual’s experience and opinion about his or her “problem” is taken into account. For the author, health is not a state, but rather a process of social, psychic, and biological adaptation in the face of the infidelities of the environment that are experienced^[12].

Following this perspective, an individual’s life becomes a constant struggle to build, in the face of an unfaithful environment, the capacity to use his or her potential and even manage to overcome difficulties and institute new ways of living and new norms. Canguilhem will call this vital phenomenon “normativity”. “The normal man is the normative man, the being capable of instituting new norms.” (p. 54)^[12].

Associated with the ergological perspective we summoned the scientific approach of Psychodynamics of Work (PDT) developed by psychoanalyst Christophe Dejours in order to contribute to the analysis of the activity of firefighters. In dialogue with the ergological perspective, work environments, according to PDT, are permeated by unexpected events and there is always a discrepancy between what is prescribed and what is real, and to work is to fill this gap^[13].

To deal with these work influences, the worker develops defences that Dejours (2004) defined as individual and collective defensive strategies that have the objective of adaptation, enabling the worker to dominate and minimise the awareness of suffering. According to Dejours (1999, p. 18), “if suffering is not always followed by decompensation, it is because the subject develops sufficient defences against suffering^[14]”.

Another important factor that can contribute positively to the worker’s health is recognition which, according to Dejours (1999), follows the dimensions of promoting sense of work through the observation (by others and by the worker’s contribution to the organisation of work) of its value, associated with gratitude. This recognition goes through judgments about its utility (economic, social, or technical) and its beauty (conformity to the rules and originality)^[14].

3. Methodology

The present research is qualitative in nature and proposes to understand the work-health relationship with a focus on the subjective experience of the military firefighters who worked in the search and rescue operation of the 272 victims in Brumadinho, MG.

To approximate these experiences, individual interviews were conducted with seven firefighters, six males and one female. The inclusion criteria consisted in being a firefighter and having worked in the search operation carried out in Brumadinho. About the functions performed, three acted only in the operational, two in the adminis-

trative, and two in both functions at different times. The ranks of the participants were: One corporal, four lieutenants, and two majors. The ranks and the time of performance are highlighted in the speeches of these workers.

The purpose of the interviews was: To know the process and organisation of the firefighters' work in the rescue operation in Brumadinho; the activity of these professionals in this scenario; to identify the debate on standards and the renormalization mobilised; to identify the possible risks of work to health, as well as the defensive strategies used by these workers.

Participants were contacted by e-mail or communication app message with an invitation to participate in the research. Due to the Covid-19 pandemic, the interviews occurred through the Zoom platform and lasted an average of 60 minutes, during the period of June to July 2020. The interviews were recorded and transcribed.

We establish a dialogic relationship, following the questions of a pre-established script, however, not being restricted to it. The main issues addressed were: The first moments of the performance in the operation; the organisation of work; the different work relationships; the difficulties encountered at work; and the perception of health of these firefighters.

To help analyse the interviews, the NVivo 12 software was used, which allowed the creation of categories and organisation of the statements. Then, we proceeded to systematisation and thematic categorisation based on content analysis^[15]. The interpretation, through the construction of categories, according to Minayo (2010), covers grouping elements that interrelate to establish classifications. That is, organising the analysis by categories means grouping elements, ideas or expressions around a concept.

The categories created and used in the organisation of the speeches were: 1. when they heard about the disaster, 2. when they were invited to work, 3. when they arrived at the site, 4. their working hours in the first month and in the following months, 5. their functions, separated by area of activity (administrative and operational), 6. work relations with colleagues on the same team, superiors, professionals from other sectors, affected people, and with Vale S.A., 7. work conditions and environmental infidelities, 8. defensive strategies, 9. renormalizations, 10. recognition, 11. care, and health complications.

The material was interpreted in the light of the theoretical framework of Worker's Health, Psychodynamics of Work and the ergological perspective, contributing to the production of senses and meanings.

4. Results & Discussion

According to the Military Firefighters' Statute, the

military firefighters are responsible for the prevention and extinction of fires, search and rescue services, and for providing assistance in cases of floods, landslides or catastrophes. According to the same Statute, the career of military firefighters is divided into two distinct groups, with different ranks and degrees: The Officers, who start as Soldiers and go up to Sub-Lieutenants; and the Officers, who start as Second Lieutenants and can reach the rank of Colonel.

Regarding the functions of each rank, the Military Firefighters Statute assigns to the officers the responsibility of leadership, organisation, and command functions of units and rescue teams. The Sub-Lieutenants and Sergeants are responsible for assisting and complementing the Officers' activities. Corporals and Soldiers, on the other hand, are considered, essentially, to be field workers.

The areas of performance are divided into administrative, with day shifts of six hours a day, with responsibilities for internal services of approval and release of security projects for residences, stores, among others; and operational, with work schedules of 24 hours on, 72 hours off and duties previously mentioned in the Firefighters' Statute.

In order to produce a general understanding of the experiences of these workers in the search and rescue operation in the city of Brumadinho, initially apprehend with the research participants how was this first contact with the news of the event, their convocation to act and their arrival at the site of the disaster.

4.1. First Moments of the Operation

Because an occurrence can happen at any time, one never knows if the professionals will be available or for how long they will be away from home. The firefighters' work definitely does not involve any sense of routine, which in itself provides constant invasions of their personal lives.

All of them presented in their speeches the readiness and desire to act immediately in the operation and, according to their reports, this desire was also very present in their colleagues. The WhatsApp application was the initial and main means of transmission of information and where they received the news of the rupture.

However, this sense of responsibility for the fulfilment of their duties also contributes to the constant invasions of the boundaries of their professional lives into their personal lives, where they are frequently taken away from their family and rest spaces. Some were on vacation and reported learning about the event while travelling with their families, which made them decide to cancel their trips.

"In the case of Brumadinho it was no different. I also had some personal things to do, naturally, five days. I didn't even know that it would be five days, I went without knowing when I would

return. I didn't go 'Thursday you are there', I just went. I just picked up my disaster kit and went." (Cab. G.—8 working days).

The operation carried out in Brumadinho had repercussions at a national level and had an extreme impact on the state of Minas Gerais. The feeling of having participated in an operation of such proportions was a great source of pride for the firefighters and the response of the community to the work done was of utmost importance for the motivation of these workers and even for their health.

According to Dejours (2004), recognition can manifest itself in a symbolic order, in most cases represented by gratitude for the service rendered, or in a material order (a fair salary, bonuses) ^[13]. In the case of the work of the firefighters in Brumadinho, we can highlight a great symbolic order represented, mainly, by the gratitude from the people affected and of Brazilian society as a whole.

Criteria such as years of work and experience were taken into consideration to select the firefighters who would act due to the large number of requests for volunteering. Being chosen to act among so many firefighters, especially at the beginning of the operation, brought positive feelings such as: Recognition, appreciation, and pride to these professionals.

Besides those who could not act immediately in the rescue and search for victims, I had the opportunity to interview and know, in detail, the first moments of the firefighters' actions through the words of Major C., a helicopter pilot who, within 16 minutes of the confirmation of the tragedy, was flying overhead.

"It was a Friday; I was on pilot duty at the air operations battalion. [...] it was around lunchtime, I was having lunch [...] then the barracks bell rang [...] I interrupted my lunch and walked to the operations room [...] the history that came to us was of a dam breaking, [...] at first he thought it was a prank call and when the caller answered, he spoke in a desperate crying voice and informed us that everything in front of him had been washed away by the mud and immediately I determined the necessary steps for the activation of the aircraft [...] About 16 minutes later we were already flying over the area and it was possible to get an idea. There is a mountain range that divides Belo Horizonte from Brumadinho and as soon as we crossed the mountain range, we saw that the dam had really burst [...] The bridge where the train passed had been taken by the mud, a derailed wagon, some vehicles overturned in the mud, little trace of a residence, in some places we could only

see the roof of the buildings and the mud was running slowly. The first association we made was with Mariana in 2015, when the dam was breached." (maj. C.—22 working days).

Rescues of live victims, unfortunately, occurred only on the day of the incident. As the disaster of the Córrego do Feijão dam collapse produced high levels of burial due to the dumping of mining tailings, the chances of finding victims still alive the next day were very low. Only Maj. C., among the interviewees, had rescued people alive and could describe the two rescue processes in detail.

"As we were flying low over the ground to try to visualize someone, it was very difficult to distinguish what was a person and what was mud, because everything became monochromatic and, at a certain moment, residents began to gesticulate to the aircraft [...] then we saw two young men approaching a person in the mud [...] and this was the first victim we could visualize who needed immediate help. Their assistance was complicated because of the time spent in that maneuver; they needed to maintain the most precise point possible to avoid hitting the people who were disembarking, so that the operational crew could work more easily [...]. They used a piece of equipment that is a safety guts, went under her armpit and managed to remove it." (Maj. C.—22 working days).

"We also had P. who was rescued, I landed in a corn field, disembarked from the aircraft and turned off the aircraft and went to her with the other 2 crew members to immobilize and prepare her for boarding and take her to the doctor and nurse for a better evaluation." (Maj. C.—22 working days).

Regardless of the "miraculous character" of finding victims alive in the days after the incident, the firefighters spared no efforts in organising the operation and in the search for the missing people. This organisation had to be immediate, and the very next day, firefighters from different parts of the country were already in the city ready to act.

The firefighters that were initially sent in were faced with roads blocked by mud, with air access being the most viable. The difficulty of mobility and response by land routes promoted other problems to be solved, such as a large number of helicopters circulating in the airspace of the city of Brumadinho, as there were not enough helipads, besides the lack of equipment for air control. These are important factors to be discussed when preparing and investing in disaster risk prevention policies in municipalities and states, especially those that already present clear

risks or frequent experiences.

The firefighters' operation in Brumadinho presented different renormalizations, in the light of ergology, to deal with the infidelities of the environment. It is important to understand that it is not possible to completely apprehend what constitutes the activity of work, because there is always an unpredictability, especially in the work of firefighters in emergencies and disasters. This unpredictability, or infidelities of the environment according to Canguilhem (2009), reinforced by the ergological perspective^[10], by stating that the environment is never identical, is necessary to understand the work of firefighters and exposure in disasters.

Facing these difficulties instigates a debate on standards in order to promote quick and intelligent solutions. In this first difficulty, the firefighters occupied a soccer field where they marked and organised the aircraft landing site. About the lack of air operations infrastructure, through communication with the control tower of Belo Horizonte's airport, the firefighters managed to source portable equipment that solved the initial problem, until an official radio structure was established.

At first the firefighters used churches and a college to establish their operational bases. As the operation progressed, they built a base very close to the broken dam and named it Bravo base. It was a base strategically designed to keep the firefighters close to the site of operation, since access was not simple and demanded a lot of time and effort from these workers.

"The conditions were very simple, we slept in a church. There was a Catholic church that was the logistical base, then there was the Evangelical church where we slept, and then there was the Jehovah's Witness church where we washed our clothes. Everybody got together, it was really cool. I felt a lot of good there, you know? Despite the very heavy scenario, but a feeling of help." (Cab. G.—8 working days).

As in the daily work, they were organised in two areas of action: One operational and the other administrative, besides the division of the work sites into hot, warm, and cold areas. The operational team is responsible for the search and rescue of victims and worked directly in the place where the tailings went through (hot area). The administrative firefighters were responsible for the development of strategies, organisation and coordination of the teams and worked in both areas, but were more connected to the cold area, which was the operations centers; and the warm area, where the bodies and body remains were taken to be identified.

At the beginning of the operation in Brumadinho, the firefighters' work routine started at four o'clock in the

morning and ended at eleven o'clock at night, having four to five hours of sleep. In addition to the unpredictability of what they would encounter in the field, the return schedule was also uncertain, with some workers being earlier and others later due to the complexity of the situation^[4].

"Every day was a different schedule, for example, there were some days that the army aircraft left us in the field, some days it was firefighter aircraft, other days it was on foot. Then, if you were close to the base, you would come back quickly, if you were far away, the helicopter would be delayed because of something, then you would stay there until almost nightfall." (Lt. D.—50 working days).

Due to the high demand that these professionals faced, a weekly rotation was established. The firefighters would arrive on a Thursday to relieve those who were already working there and leave on the Thursday of the following week, these rotations were repeated until the end of the operation. The firefighters who had been working could be called back to work again.

The weekly rotation was presented as a strategy of care and a concern with the exhaustion of workers, which does not reduce the experience of seven exhausting days of work, but rather prevents its continuity. Through the speeches of the firefighters, we can perceive days of work with a high workload, accumulation of demands and high level of responsibility, factors that studies have associated with the overload of mental effort^[17, 18].

This extensive and intense routine with high workload was associated with unregulated sleep that remained for some time after exposure to the disaster. According to Santos et al (2018), extensive work schedules provide difficulties in social, personal, and health relationships with self-care and can be associated with inappropriate health behaviours such as alcoholism, smoking, sleep disorders, and musculoskeletal diseases^[19].

Together with the long working hours, there is the experience of working in the field of disasters, which makes military firefighters even more vulnerable to the multiple situations that produce high levels of stress^[20]. Different studies point out that the experience of extreme situations is enough to negatively influence the worker's health and work performance^[20, 21, 22], highlighting the prolonged exposure as an aggravating factor for negative health effects^[23].

In a survey of 11,701 firefighters exposed to the World Trade Center (WTC) disaster in 2001, 4,269 (36.5%) were at high risk for Obstructive Sleep Apnea (OSA), although 828 (7%) reported receiving a medical diagnosis for OSA^[24]. Other research also warns of immediate increases in the occurrence of musculoskeletal, psychological, respiratory, fatigue and sleep problems in firefighters following disaster

exposure^[25, 26, 27].

4.2. The Performance of the Operational Firefighter

In the first days of the search, the firefighters reported the ease of finding bodies and how the strategy was organised. Access by land was initially unviable, so helicopters flew over the site and, when a body was identified, the location was plotted using GPS. Later, the helicopters took teams of three to four firefighters to the marked places; they left them there to prepare the bodies and, possibly, identify new ones.

"It was so much that people would even say, without any pejorative sense at all, you would walk in the field and you would trip over a body, it was a lot of bodies everywhere. You would look like, 'what is this here?' It is a body. So, the search activity was even easy in the beginning, because it was a lot of people, a lot of scattered bodies" (Lt. D.—50 days in the field).

The firefighters reported that often the GPS location did not offer a very precise position, thus hindering the work of those who had been sent to collect the bodies. In order to solve this problem, they used white marked pipes stuck in the mud near the body. Some aircraft were assigned to fly closer to the mud in order to position these pipes and facilitate the work of locating the bodies by the teams that would later pass by to collect them.

This demonstrates the great complexity behind the work of these professionals and the extreme need for very well coordinated work. This coordination was only possible due to the strong dedication of these workers to finding the victims, which was fundamental to the success of the mission.

The main objective of the firefighters, regardless of their function, was to find the missing victims, mentioned as the biggest motivation for their work by all the interviewees. The firefighters, in their speeches, expressed the importance of finding the bodies for the grieving process of the families, which proved to be a reinforcer in the motivation of these workers.

These issues refer to what Dejours (1992) will call symbolic satisfactions which, according to the author, "[...] is the qualitative experience of the task. It is the meaning, the significance of work that matters in its relations with desire." (p. 62)^[28].

"I really wanted to stay, but there was no option. This was the feeling, because it is that thing of 'just one more, just one more body, just one more person', and this was very latent, not only for me but also for some other soldiers who had the same feeling. We wanted to be there to comfort a family, to close a cycle for

that family." (Cab. G.—8 days in the field).

Not all firefighters coped well when they came across the bodies or remains of victims, there were reports of professionals who asked to step away from the operation in order to protect themselves. When questioning them about these encounters and how they dealt with them, the separation of work life and personal life was a factor highlighted by some. Keeping the memory of these experiences within the work environment and avoiding commenting on the subject in external places were strategies mentioned.

On the other hand, other firefighters report that talking with family, friends, and co-workers about their experiences in the operation was an important factor that helped them cope with anxiety and assisted in the process of re-signification.

During the search process, at certain times the firefighters needed to move through mud that was not completely solid, besides representing a risk for these professionals due to the possibility of developing musculoskeletal problems, because of the great physical effort, there was the possibility of contamination with the metals present in the tailings. A strategy used was the use of wooden tarps that were placed at strategic points over the mud to facilitate the movement of these professionals, allowing access to risk locations.

The firefighters carried these boards with them in the helicopter and used them when they found a body in an area where the mud was totally unstable. The body would be surrounded by these wooden boards, each fireman would stand on one, and the helicopter would leave them there while they prepared the body for transport.

The firefighters who worked in the operational area searching the tailings were affected by muscle pain or even developing more serious problems due to the irregularities of the mud and many hours of standing on this surface, without any previous exercise. An important factor to note was the great demand for physiotherapeutic care.

In the case of Lieutenant G., he talks about how the work in the field affected his health when he developed plantar fasciitis due to hours of working standing in the mud. The Lieutenant reports that this problem affects him to this day with pain and physical restrictions. Despite his desire to return to work in the operation in Brumadinho, due to his physical condition, he was ordered to work in the administrative area of the operations command.

"In my case my right leg developed tingling, it was muscle fatigue, this I felt for two weeks after my return and I thought it was fatigue. Until it got to a point where the right leg didn't feel anything anymore, but the left leg, I don't

know if you have ever felt a muscle stretch, it felt like it was tearing. So, every time I put my foot on the floor, I started to feel this. [...] After doing some exams the problem was identified. It is an inflammation that occurs in this fascia, right, in this membrane that is between the skin. [...] I can't do physical activity, right, I can't run because it can aggravate it, it can injure even more, aggravate the situation even more, so I was suspended from physical activities." (Lt. G.—118 days in the field).

The risk of developing musculoskeletal problems is very present in the work of firefighters, especially in emergencies and disasters. About 18% of the firefighters who were exposed to the WTC disaster were affected by musculoskeletal problems while in the El Al Flight 1862 air disaster in Amsterdam about 54% of the exposed firefighters had complaints related to musculoskeletal symptoms^[29, 30].

There were working areas where the mud was very wet and these workers had to crawl to reach certain places. Although they used protective equipment in order to reduce skin contact with the tailings, contact was inevitable due to the irregularities present in the mud. It is possible to see in footage and photographs, available on the Internet, the work of firefighters and how the tailings came into contact with the neck, nose, mouth, and eyes of these workers.

The toxic content present in the mud was also a fearful factor for the firefighters due to possible contamination. This fear was not restricted to the individual, but also of contaminating their families when they returned home. Some firefighters reported needing to stay isolated after the operation until the tests indicated that there was no risk of contamination. In addition to spending days away from their families and friends, this isolation continued even after they returned home, further affecting their emotions.

Exposure to this contaminated mud can trigger allergic skin reactions, burning sensations, and discomfort. In a survey with the riverside population of Colatina/ES, Rocha et al (2016) identified a significant increase in the incidence of diarrhea, fever, and skin diseases in the population^[31]. The firefighters who were exposed to this mud undergo decontamination monitoring with a forecast of 20 years of follow-up. This data, to date, is kept confidential by the health board of the Military Fire Department of Minas Gerais.

This work of searching for victims in the midst of a catastrophic scenario full of risks made some firefighters realise the value of their work and understand that few people could be doing the same as them. This feeling of recognition was an important factor in motivating and fulfilling the work of these professionals.

"I think the feeling I had was that I could do something that almost nobody else could do. Like Spiderman, 'with great powers come great responsibilities', there I didn't feel like Spiderman, I felt more like Mud-Man. So, I felt I was part of a minority there that was actually making a difference in the whole scenario and that weighed a lot, that we carried with a lot of responsibility, but also with a lot of pride." (Cab. G.—8 days in the field).

To achieve recognition it is necessary, according to Dejours (2004), "to bear witness to your experience of working, to make visible the discoveries of your intelligence and your know-how is the means of obtaining recognition from others." (p. 33)^[13]. In view of Corporal G.'s speech, we could observe the importance of recognising the relevance of his work.

4.3. The Performance of the Administrative Firefighter

On the other hand, we have the firefighters who worked in the operations center developing strategies and coordinating teams that worked in the field. For those professionals who had the opportunity to participate in both areas, it was possible to talk about the differences and challenges encountered.

Broadening the knowledge about the disaster; having a closer relationship with the people who were affected; knowing the region and understanding it holistically; working on the morale of the teams; and constantly developing search strategies were issues raised by these firefighters as the main characteristics of the administrative work and what differs from the operational work.

Some firefighters were able to experience the change of functions and reported that, when they were operational, they didn't have much knowledge about the work that was being done, becoming aware of it only when they started their work in the operations center. This issue was observed by Lieutenant C. as a problem that needed to be solved.

"I was able to get to know the operation as a whole, because generally those who are in the victim search area have a more directed vision and this was one of my concerns when I arrived there because I saw that many people had a very segmented vision. [...] So we gathered all 140 military personnel and gave them a general briefing about the operation: 'you are going to look for a victim there because of this, because with the crossing of data there is the possibility of having a victim there'. It was a very

important job of planning and intelligence.” (Lt. C.—60 days in the field).

The development of strategies is a very vast area that covers the entire operation in order to deal with the difficulties presented, for example: how to deal with the families and pass on concise information and comfort them; where to search for the victims; organise the work and worry about the safety of the firefighters; deal with other sectors; organise the information that comes from everywhere; obtain knowledge and study the terrain.

Faced with so many complex functions, managing people has proven to be a very difficult task for firefighters. The demand for the development of new strategies and results and having to deal with different subjectivities in which each one presents his/her own specific issues and way of facing situations was a source of greater suffering for these professionals.

Thus, the firefighters who held this leadership position mobilised their subjectivities to deal with the different subjectivities that coexisted in the same work environment and needed to make choices that coincided with the operation and with what was best for theirs and other firefighter teams. Schwartz and Durrie (2021) will call this mobilisation “dramatics of the use of self” that refer to work situations where there is always a destiny to be experienced and this destiny will be determined by choices^[10].

“There were cases of victims and very sad situations, when the firefighter found himself in certain situations, he was emotionally shaken and asked to be removed. There have also been cases of indiscipline, where we had to take action on the part of the operation’s command; this also affects you. [...] A person runs away from the proposed path, you end up having to take a more drastic attitude, so this also affects your morale for a while, but then you realise that it was the best option and you get back on track again.” (Lt. C.—60 days in the field).

Lieutenant C. points out a difference in the physical and emotional stress among the firefighters who worked in different areas, emphasising the emotional stress suffered by the firefighters from the administrative area where they were under constant pressure to develop more strategies and need to deal with different people in different situations. The use of self for oneself and for others implies making choices and the officers who held management positions were constantly faced with the pressures of the dramatic use of self.

“The people who worked in the field searches, we noticed that they were more physically tired, the people who worked in the

planning part had a little less physical wear, but on the other hand, the emotional wear was greater, because they were under pressure all the time, you have to develop the operation, you feel responsible for the efficiency of the operation.” (Lt. C.—60 days in the field).

These pressures occurred at different times with different intensities, since the operation presented several phases and along with them their changes in the work that directly influenced the morale of the troop. The mobilisation of the use of self was constant, due to the new risks that arose over time.

4.4. The Course of the Operation

In analysing the working conditions of the firefighters, we also observed the differences in the injuries present at the beginning of the operation and during its course. The firefighters who worked in the first days after the dam broke faced more precarious working conditions than those who arrived later with structured bases and more organised work processes.

Several studies have discussed the level of exposure of firefighters to disasters as a risk to their physical and mental health, especially when they act in the first moments of the critical event, which has far greater negative health effects than firefighters who act later^[32, 33, 34, 35].

Subsequently, the goal was set to excavate three metres deep of the entire territory invaded by the mud. Even with this goal, there were places where a large concentration of tailings settled and some firefighters were directed to these areas in order to dig and find what they called the “zero pit”, which would be the original level without dumped tailings.

“In the first phase the mud was very liquid, so what was done in the beginning? Surface search with aircraft, with dogs, sweeping the ground, lots of amphibious machinery, and then the mud was hardening, so new strategies were created. [...] In the fourth phase, we were digging deeper and making folds in the earth [...]. A machine came, dug the soil, left the soil in a corner and turned it over two or three more times, then another machine came, took the same tailings, sieved it to really verify. It is like looking for a needle in a haystack, there are a lot of things to look for, you have to have a very good intelligence work. [...] In the fifth phase, for example, there were more superficial excavations of up to 3 meters, but longer, because the rainy season was forecast and this would disturb the search in the tailings. During

the excavation, when the tailings became too wet, it would hinder the sieving. [...] To have an idea, there were tailings that were more than 15 meters long, so we had to dig 15 meters to get to what we called the zero pit, which was the previous terrain, and then we were sure that we had searched completely there and that there would be no victims in that square meter.” (Lt. C.—60 days in the field).

The search work required a lot of attention and focus from the firefighters who were there, because they had to keep an eye on the tailings that were being turned over to find, sometimes, small remains that could identify a victim. Because it was an open-air job, the firefighters were exposed to sunlight for hours, which was difficult for them to keep their attention on their work task.

The constant state of alert was represented, by these workers, as a source of stress, influencing negatively their health. The association of the prolonged state of alert with increased stress and physical and mental exhaustion of firefighters was also made by other studies^[36, 37]. González (2006) points to the relationship between this state of alertness with the development of sleep disorder, fear of getting sick, irritability and other negative ways of influencing the health of workers^[36].

Spending hours sifting through the mud and not finding a body or the remains of a victim was presented as a reason for sadness, demotivation, and even guilt. Frustration is directly reflected in the production of recognition that, according to Dejours (2011), “is led to doubt the relationship he maintains with the real, to doubt himself [...]” (p. 64)^[38].

“One of the things that made me sad and demotivated was when, in a whole day, you couldn’t find anything, an important segment in the case a tooth, a hair, a thing that would help to identify. [...], but there is the emotional part, if I didn’t find anything I would be sad thinking about what I did wrong, what I can do to improve.” (Lt. C.—60 days of acting).

“The biggest problem that we faced there during the weeks was the frustrations of the troops in not finding what they were looking for. So sometimes the professionals would go there, spend a week there and find nothing.” (Maj. P.—205 days in the field).

In order to deal with this new problem, the administrative firefighters spread posters with pictures of the victims still missing, who were referred to as “jewels”, throughout the operation bases and the search teams. Moreover, every time a victim was found and identified, the news spread. They made a point of congratulating everyone, because it was the joint work that made this identification possible.

The cooperation that is established in the activity contributes to provide the feeling of self-realisation that, in turn, strengthens this collective^[13].

4.5. The Multiple Labor Relationships

Regarding the strengthening of this work collective, the different relationships established by the firefighters with their professional colleagues, superiors in command, other sectors acting in the scenario, the affected population and even with VALE S.A., demonstrated an important role for the success of the operation.

It is emphasized that “[...] we understand by work relationship all the human ties created by the organisation of work” (p. 75)^[28], understanding that “[...] the quality and dynamics of relationships within work collectives have considerable, if not decisive, weight in the effects of work on health.” (p. 87)^[14].

Paying attention to and caring about the condition of one’s colleagues, with the same degree of importance that one should have for the emergency and possible victims, has been shown to be an important defensive strategy. First as support and emotional control of the team and, second, by observing how their colleagues deal with the adversities of the operation, the firefighter ended up absorbing these ways of coping and felt safer in case it happened to him.

Due to the high physical risk of the profession, firefighters always act in teams and are ready to act cooperatively with their colleagues. This practice also serves as a defence mechanism against the psychosocial risks of the job. The amount of time that firefighters from the same team have worked together has been shown to strengthen trust and has promoted a good relationship between colleagues and superiors.

The trust that superiors convey to their teams has also been shown to be extremely important to the work effectiveness relationship. When trust becomes reciprocal, a good working relationship is established between superior and subordinate. The freedom to work, arising from this trust, becomes something positive even for the strict standards of militarism.

According to the firefighters interviewed, the trust present in the different relationships was an important factor that positively influenced the health of the workers. This result dialogues with studies that link trust at work with the development of the activity, spontaneous cooperation, safety, and workers’ mental health^[22, 39, 40].

In order to reinforce the importance of developing trust at work, Dejours (2004) states that the collective field of work, sustained on the basis of trust, offers favourable conditions for subjective mobilisation and promotes spon-

taneous cooperation^[13].

“From the beginning, Colonel A. and Colonel P. were in charge of the technical part of the project. The guys are too good, they are very good. So, we had working conditions” (Lt. D.—50 days in the field).

The firefighters’ contact with the affected population took place in several ways. At the beginning of the operation, this contact, most of the time, occurred only by exchanging glances or a celebration with applause, which was enough for them to feel the expectations placed on their work.

The firefighters reported contact with children, and both experiences were recounted with happiness and excitement. The tributes paid by them proved to be a factor that positively influenced their motivation to work in this operation.

“This little girl had an envelope in her hand, a small envelope, right [...] She looked at it and gave me this envelope. [...] She said in the letter ‘thank you firefighter for finding my father’.” (Lt. G.—118 days in the field).

Although the firefighters’ relationship with the families was positive in different situations, in later moments this relationship presented itself a little more complex. The firefighters had to deal with families receiving false news about missing family members who were supposedly found; the anguish of family members receiving small remains of their loved ones and; the long duration of the search and whether the firefighters would continue until they found the last missing person.

In order to deal with these issues, during the course of the operation, meetings were organised with family members and professionals from other sectors every Wednesday, in order to share information about the operation and keep family members informed about what had been found and what was being done. Groups of official press releases were also created by the fire department to prevent the spread of false news.

The concern in passing the clearest information possible and being ready to receive the doubts of family members and other people affected by the disaster, resulted in a closer relationship between the firefighters and the families and a greater trust in their work. This process of social interaction and sharing of information with the public, along with flexibility to meet different demands, is linked to what different studies point to as aspects of a highly trusted organisation^[41, 42].

Additionally, the firefighters’ relationship with the company Vale S.A., which provided support for the work of these professionals. The company guaranteed whatever was necessary for the execution of their work, such as

quality equipment and infrastructure. Many agree that, in terms of support and infrastructure, the operation in Brumadinho was unique and they lacked nothing.

4.6. The Duty Accomplished

Finally, we sought to understand the firefighters’ overall view of acting in the disaster where many brought up the issue of learning and how they feel more prepared to act in emergency and disaster scenarios.

“The face, I’m proud. I am proud that I was useful, I did my job, but we did more than just our job. We did much more than our obligation there. We are still doing it. So, this is a reason for pride, yes. The family feels proud. In fact, I managed not to bring negative things into my life because of the operation.” (Lt. D.—50 days in the field).

The feeling of accomplishment was present in the speech of most of the firefighters interviewed and proved to be an excellent ally in facing adverse situations at work. The military model makes workers see their work as a mission that must be successfully completed in order to serve the population and, in the case of the Brumadinho operation, this model presented itself as a way to minimise the suffering caused by the burden exerted on these professionals and the adversities of the environment to which they were exposed.

This result is in agreement with Breda and Drumond (2020), as they concluded that the collective defensive strategy of facing the work as a mission, focusing on meeting the needs of the population, demonstrated its character of minimising the suffering generated by the load demanded of these professionals^[27]. For the authors, transforming the work into a mission is interpreted as a way for the firefighter to do what was proposed without questioning, taking away the place of desire in the decision-making process aiming at the conclusion of the task.

The same result also dialogues with the findings of Oliveira’s (2019) thesis on the work of firefighters in the disaster caused by SAMARCO S.A. in the municipality of Mariana in 2015, where the author highlights commitment to the mission and pride in being part of the organisation as key points in building trust and meaning of work. It was also noted an expressed willingness of the firefighters to exert considerable effort on behalf of the organisation and its values, due to a strong belief in and acceptance of the institution’s goals^[43].

It is important to emphasise the several risks present in the organisation of work and, in the case of the operation in Brumadinho, however, this model appeared in a way to alleviate the damage of these risks to the health of these

workers. The full awareness of the risk involved in their work, which often involves acts of heroism and bravery, was an important factor for the recognition of these workers. These findings are in line with the findings of other studies ^[43, 44].

The firefighters stated that the experience of working in the Brumadinho operation made them feel more confident in performing their tasks and more prepared to act in disaster scenarios.

Finally, it is important to highlight this hero figure carried by these workers that, no matter how much recognition and pleasure it may provide, it is clear all the suffering behind all the work performed, and there is a risk of these sufferings being made invisible by an ideal of hero that does not weaken. Facing this risk of being invisibilized, labor clinics are an important tool to bring light to the experiences of these workers and further promote health care policies for firefighters.

5. Conclusions

The dam collapse had great national repercussions and was reported by major national and international media outlets, highlighting the work done, especially that done by the firefighters who worked directly in the rescue and search for victims. Working in this event produced a feeling of pride in all the firefighters interviewed, with great recognition, engagement and commitment to the corporation.

Working in a catastrophic event always permeated with uncertainty made the firefighters reaffirm the value of their activity, when they concluded that they were the only ones who could do it. Along with this, the motivation to find the victims valued the meaning in work, which tended to strengthen resilience to the psychosocial risks of exposure to this scenario.

The more than twelve hours of work per day, with only three to five hours available for sleep, contributed to the fact that sleep remained unregulated for some time after their duties. The diet and the lack of time to exercise (related to the risk of musculoskeletal problems) were also signalled by the firefighters as poor conditions to work and their health.

This exhausting work promoted greater physical and mental wear on operational firefighters. Standing for long periods in the mud was the greatest cause of musculoskeletal problems, while those who had to crawl had greater anxiety about the toxicity of the mud. The continuous hours of work in direct sunlight also presented physical and psychosocial risks to these workers.

As for the firefighters who worked in the administrative area, the emotional stress was due to the pressure to develop strategies and deal with the morale of the troop. The

operation presented different phases that always demanded new strategies to search for victims, and these different phases influenced the morale of the troop. Thus, the firefighter who occupied this leadership position needed to mobilise his subjectivities to deal with different individuals who presented different issues and ways of thinking about the situation.

These risks to the health of the firefighters also varied between the different phases of the operation, but showed greater intensity in the firefighters who were exposed to the first moments of the disaster.

A strong working collective was identified between the firefighters and the different sectors that enabled the effectiveness of the operation and a greater support network for the risks of the job. The defensive strategies of seeing the work as a mission; observing the emotions of colleagues at work; learning how each one of them dealt with situations; and talking about the experience of working in the operation, evidenced good instruments that the firefighters used to better deal with the suffering arising from the risks present at work.

The organisation of the work evidenced mechanisms that encouraged freedom and confidence in the firefighters' work, allowing a free process of renormalization in a work environment full of unpredictable risks. All the firefighters stated that working in the operation made them feel more confident and better prepared to act in other disaster occurrences.

Based on this work, we believe that the topic of disasters and the health of firefighters in these scenarios is still in the process of consolidation. Therefore, there is a need to produce research focused on the health of these workers and to use it in order to increasingly improve public policies and better develop disaster response activity, especially when faced with the scenarios pointed out in relation to climate change. However, for public policies to be truly effective, it is necessary to overcome the centralizing approach and empower local agencies, making them active agents of disaster risk reduction.

Thus, we believe that the greatest contribution that this research has offered is in encouraging reflection on the issue of disasters and the performance and health of workers in these scenarios, in order to guide the planning and implementation of public policies, performance and risk manuals, emphasising the reflection capacity and experience of the firefighters themselves.

Conflict of Interest

We confirm that neither the manuscript or any significant part of it is under consideration for publication elsewhere or has appeared elsewhere in a form that could be

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ARTICLE

Perceptions and Experiences of Adult Learners of Online Learning in the Era of COVID-19 in Ghana

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Abstract: The COVID-19 Pandemic has undoubtedly affected learners, and as such, adjustments need to be made for successful teaching and learning through online learning. However, in Ghana, the effects of the COVID-19 Pandemic did not spare adult learners who are compelled by educational reforms to upgrade themselves academically using online learning platforms. Using a descriptive design, the study explored the perceptions and experiences of 166 (online data collection) adult learners as they pursue their academic programs through online learning. An adapted questionnaire on perceptions and online learning experiences developed by Khan, Nabi, Khojah, and Tahir (2021) was used for the data collection. The Confirmatory Factor Analysis technique was used to analyse the data. The study revealed that respondents felt confident while using online learning content but refuted that those technologies permit them to take tests and submit assignments electronically. Furthermore, the study revealed that online learning service was making the learning process very simplified. The revelation means that adult learners possess positive experiences and perceptions about online learning. Therefore, online teaching and learning in higher education institutions should be made a routine activity in Ghana even after the COVID-19 Pandemic because the world is approaching a technological world.

Keywords: Perception; Experiences; Pandemic; Adult learners; COVID-19; Self-efficacy; Ghana

1. Introduction

Knightley^[1] notes that education for all members of society is a topic under examination by governments worldwide, and the promotion, expansion, and enrichment of educational experiences is one of the issues under study. This puts a strong emphasis on lifelong learning and learning throughout one's life^[2]. In education, there are

currently some heated debates over how to make education more open and significant throughout one's life^[3], and there is also an emphasis on how to include less advantaged or socially excluded individuals in educational opportunities. Successive governments appear mainly attentive to the personal, individual benefits that people can derive from up-skilling, retraining, and the broader socio-economic benefits of these activities. In this 21st

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century, adults are encouraged to return to school and earn academic qualifications that would put them in shape to benefit from the growing world of opportunities ^[4,5]. The features of adult learners are dissimilar from those of conventional students. Adult learners know why they are being taught and what they need to learn ^[6]. It is also well-recognised that adult learners, who come from various educational backgrounds and have various educational goals, desire to reflect on their educational experiences during their education ^[7]. In addition, the fact that they have duties in their everyday lives that differ from those of other learners impacts their educational experience ^[8]. As a result, a learning platform where adult learners can define their scholastic processes, share their beliefs in a comfortable environment, and continue with their educational process while maintaining their personal lives is required. The flexibility that online learning environments allow for adult learners, who are conscious of their learning requirements and expected to control their scholarship processes, makes it ideal for them to pursue relevant educational opportunities.

There has been an increase in adult students enrolling in distance education online, although the number of scholarly works about adult students is substantially fewer than conventional students ^[9]. Young adults and older adults are two categories of adult learners, based on their age. Adults above 22 who continue their education while caring for their families and working can be considered adult learners ^[10]. As a result of these differences, adult learners are distinct from other students. Adult learners may benefit from these features, but they can also provide several challenges. Therefore, they demonstrate the significance of customising educational environments and processes based on student characteristics. The learner-centred nature of all instructional design frameworks necessitates developing and implementing online learning programs that cater to a broad spectrum of all learners. To achieve this goal, a complete appreciation of the relationship between adult learners' characteristics and online platforms' suitability for their online experiences is required. Using online learning platforms, learners can control their learning processes from any location and time. There are additional ways for adult learners to communicate with one another using online learning environments' capabilities (such as discussion forums and chat rooms) ^[11]. Working in virtual teams and directing one's learning are two advantages of this strategy. According to Kim et al., interaction is an integral part of online distance education, and it has a strong correlation with student learning results ^[12]. The authors also claimed that online distance education allows students to participate in personalised training,

allowing learning processes to be tailored to meet their specific needs. Likewise, Means, Toyama, Murphy, Bakia, and Jones ^[13] noted that distance education by online for adults has a significant benefit because it allows them to continue learning throughout their lives and as well cater to other socially-important tasks. Apart from the previously mentioned merits of distance learning online, it is generally recognised that adult learners face several problems including their self-efficacy while pursuing their education online. It is important to note that the self-efficacy of adult learners with computers and the Internet is crucial for online learning ^[14]. In this instance, those learners who have low self-efficacy in specific areas of the online platforms may find it challenging to succeed using this strategy.

It has been suggested by Kara, Erdogdu, Kokoç, and Cagiltay ^[6] that the difficulties associated with learner assistance may also be faced in online distance education. It is possible that adult learners do not have the same access to resources and orientation programs as college students, leading to a lack of available assistance. Because of this, individuals may feel alienated from the rest of their peers during their educational journey. When they do not receive appropriate help from their family and employers, their difficulties in school may worsen. On top of all that, individuals often have many duties and workloads such as husband, parent, coworker, and student, which adds to the overall burden and workload ^[15]. According to Park and Choi ^[16], these difficulties may hurt their learning success and may even result in their dropping out of online distance education programs or courses. Dropout rates in remote adult education are increasing, which is considered a significant problem. In a study, essential factors that influence adult learners' decisions to drop out or remain in an online distance education program were ascertained, and it was found that primary physical constraints from work, scholastic aptitude, family/personal concerns, and passion for learning influenced the decisions of adult learners to continue or drop out of online degree programs ^[17].

According to Deschacht and Goeman ^[18], adult online learners risk dropping out of online distance education if they have poor academic locus of control and metacognitive self-regulation skills. Researchers such as De Paepe, Zhu and DePryck ^[19] found that people's external and internal issues raised their chances of dropping out of college or university. A critical success criterion in online learning programs is student retention because dropout rates are high, particularly among adult learners ^[19]. Previous studies have focused on what can be done to improve the quality of online distance education and the performance of adult learners ^[14,15]. After conducting a study of the relevant literature, it has been discovered that most of

the research focuses on a specific component of remote adult education. Therefore, it becomes necessary to develop a framework and examine the current environment regarding the challenges mentioned earlier to develop future studies in adult distance education. According to recent research, a comprehensive understanding of the problems and obstacles faced by adults enrolled in online distance education is critical to developing compelling online learning experiences for them^[20].

Whether to accept or not to accept online distance education by adult learners depends on the usefulness of technology. Usoro, Echeng, and Majewski^[21] defined the perceived usefulness of online learning as a person's belief that technology would increase their capacity to do their work. Therefore, adult learners' perception of the usefulness of online distance education is determined by how much they believe that using technology would help their academic achievement^[22]. In several instances, researchers such as Masele and Rwehikiza^[23], Mollel and Mwantimwa^[24], and Mohammad^[25] found that perceived usefulness is an essential determinant in students' adoption, integration, and long-term usage of technology in education and learning.

Online learning platform users who have used online learning activities must provide feedback on the success or failure of implementing those activities. In this regard, higher educational institutions (HEIs) need to know whether implementing blended learning results in better student learning outcomes, cheaper costs, and satisfaction from all stakeholders^[26,27]. According to Al-Adwan, Al-Adwan, and Smedley^[28], there have been numerous educational institutions throughout the world that have implemented online learning platforms, but the success of their implementation requires deep knowledge and awareness of user acceptability and the utility of online learning platforms. Saade, He, and Kira^[29] state that the acceptability and use of online learning platforms by users are essential indicators of success in the long run. Thereby, it is vital to consider the user's perspective as much as possible when creating and evaluating an online learning platform^[30]. One of the essential tenets to consider in creating and maintaining a thriving online learning environment is the learners' attitudes toward it. According to Hrastinski^[31], who reviewed the existing literature on online learner participation, participation and application are inextricably linked. As a result, for learners to get the most out of participation, they must see it as applicable in the overall participation experience. According to a study by Aristovnik, Keric, Tomasevic, and Umek^[32], students' opinions on the usefulness of an online learning approach varied widely. They found that the overall impression is

critical in determining greater perceived usefulness for most learners surveyed.

Most people believe that online learning will give possible applications for students' learning activities^[33]. However, Lee^[34] notes that, the intention of users to continue with online learning is likely to be low. That is to say; it is not rare for learners in online learning situations to withdraw from the program^[35]. In the opinion of Tsai, Chuang, Liang, and Tsai^[33], there are a variety of probable factors for which students stop participating in online learning. For example, research has revealed that learners may be reluctant to participate in online learning due to a lack of trust in their ability to operate the online learning platform^[36]. A similar line of thinking has led some academics to believe that student's participation in online learning may be connected with their perceptions of their talents in terms of specific skills and knowledge. They contend that this idea, known as self-efficacy, may significantly influence learners' learning processes and learning outcomes when they are enrolled in online educational environments^[33]. Learners with high self-efficacy perform better than those with low self-efficacy in online learning situations^[37].

Another factor to consider in designing an online learning platform is its ease of use. According to Rogers and Wang^[38], the degree to which technological advancement in teaching and learning is seen to be simple to be understood and utilised is referred to as "perceived ease of use". When people are exposed to or familiar with technology, they can perceive how easy it is to use it^[39]. When people perceive a technology's ease of use, it is apparent that they will be more likely to begin utilizing the technology. As an alternative, Bridge, Jackson, and Robinson^[40] believe that adopters of new ideas and inventions who find them simple to understand are more likely to do so than those who must learn a significant amount of new knowledge and abilities. According to Konstantinids and Grafton^[41], simple technologies to integrate into the classroom environment encourage the use of online learning aids in HEIs. Another factor that influences usage is the low level of skill complexity required for use^[42], the ease-of-use opportunity provided by interfaces^[43], and the ability to quickly and easily access all types of information and materials^[44]. Among the other considerations, the ease with which instructional materials and processes may be created^[45] are a significant factor in determining whether or not instructors and learners will use online learning platforms in the future. Hartshorne and Ajjan^[46] conducted a study on learners' decisions to utilize online learning resources and discovered that ease of use had a favorable impact on online learning. In other words, ease of use is a

key predictor of instructors' attitudes regarding adopting online learning applications in learning and their desire to use them for teaching and learning. In support of this, the findings of a study by Dalvi-Esfahani et al. ^[47] showed that perceived ease of use was associated with learners' intention to continue using online learning platforms. Ajjan and Hartshorne ^[48] and Dearstyne ^[49] indicated that online learning tools enable users to share content in a far more convenient way than in the past. Furthermore, the ease with which content can be created, shared, published, and distributed expands the potential of learning technologies ^[48-50].

Furthermore, learners' quest to use online learning platforms rests on their behavioural intention. Behavioural Intention (BI) is a cognitive process that measures an individual's preparedness to carry out specified behaviours. It is a direct cause of usage behaviour. There are a variety of attitudes people show toward using online learning platforms that have a direct impact on their behavioural intentions to use those platforms ^[51-57]. The attitude of learners is crucial in determining their overall readiness in adopting online learning ^[58]. Behavioural intention to adopt online learning was studied by Jere ^[59] among university students to determine the influence it had on their decision to do so. The study found that BI directly and indirectly predicted students' desire to use online learning.

In ameliorating the challenges faced in online learning by adult learners, it is important that instructors and learners themselves understand diversity. According to Cornelius ^[60], adult learners in any program of study are diverse and bring different educational, cultural, professional, and personal stories and experiences to their learning. As such, they come with varying levels of self-esteem as learners and confidence in their own abilities. They may as well come from a range of vocational areas, each with distinctive professional identities and practices. Therefore, acknowledging these differences is one thing, responding to them as online course designers is another, and taking them through the online learning process successfully is yet another. With these efforts, it is impossible to accommodate every learner's needs and preferences, address all possible cultural contexts, and respond to differing motivation and interest levels in any online learning environment ^[60]. In other cases, adult learners cope with the difficulties of online learning by reflecting on the fruits of their labor. For example, adult learners come to terms with themselves regardless of the challenges when they think about personal enrichment, improving pay for their current job, a desire to change careers, preparing for a new job within their field, earning a required credential, interacting with other students and networking, returning to complete a degree, the availability of tuition assistance,

and renewing a certification ^[61,62].

The surge of COVID-19 in Ghana compelled higher educational institutions (HEIs) to blend the traditional teaching mode and learn with internet-based lesson delivery ^[63]. To minimise human physical contact, it was prudent for every learner in HEIs to accept and adopt the emerging medium of teaching and learning. In most of these HEIs, there is a blend of young learners and adult learners, where each category of learner was mandated to be accustomed to online learning platforms mediated by respective faculty members. Regarding the acceptance and use of online learning platforms, it is fascinating to note that young learners appeared to have a better understanding and control over the processes than their adult counterparts. It is casually stated that adult learners in Ghana are born before the computer age. This simple statement corroborates anecdotal records of the Ghanaian online learning space, portraying that adult learners in Ghana possess less ability in navigating online learning platforms because online learning was not part of their earlier training years back. Even before COVID-19 strikes, efforts have been made by the successive government of Ghana in adopting Information and Communication Technology (ICT) in the educational landscape ^[64,65], but these efforts appear to be fraught with challenges such as unavailability of ICT facilities and intermittent internet connectivity, hence the inability of many learners to use ICT-based learning platforms ^[63,66-68].

Despite the various problems (e.g., connectivity issues and technological barriers), there was also an increasing trend towards a "crisis of connection" and a "loneliness epidemic" ^[69] associated with online learning. Mbukusa, Kibuule, and Lates ^[70] described loneliness in terms of time, space, social, intellectual/experience, profession, ICT knowledge, sensory, cultural, and subject experiences resulting from being alone. According to Mizani et al. ^[71], the long periods without face-to-face classroom interactions have led to concerns about students' long-term psychological development in terms of loneliness and self-restraint. While information technology allows people to connect from all over the world, it also creates an illusion of friendship without ideal friendship, which leads to feelings of loneliness, particularly among adult learners ^[71,72]. Many adult learners experience fewer physical interactions as a result of online learning modes, which further erodes interpersonal connections ^[73]. In fact, loneliness has a profound effect on adult learners.

For instance, the feeling of loneliness among adult learners could lead to negative psychological health (mental health and well-being) ^[74,75]. In some instances, the feeling of loneliness among adult learners could translate

into reduced academic engagement and performance^[76,78] and a lack of a sense of community^[79]. In conjunction with the above, Nunez^[80] alleged in a study that most adult learners who pursue their programs online might stop along the way because of loneliness. Through online learning, many adult learners may lose their sense of belonging or networking that is fostered in a traditional learning situation. To support this view, Burns^[81] found in a study that 40% of the learners felt disconnected and lonely through online learning and eventually dropped out of the mode. Aside from the feeling of loneliness in online learning mode, some adult learners may experience anxiety, being out of their comfort zone, inequity in assessment, particularly in “group” assignments, and the perceived inability or difficulty in peer interaction, particularly in presentations^[82].

The preceding literature connotes that online learning indeed, is a challenge in Ghana and this challenge peaks in the academic lives of adult learners amid COVID-19. As a custom, most adult learners in Ghana have other social responsibilities aside from their academic responsibility. These social responsibilities appear to impede adult learners’ ability to avail themselves of any imminent change in their academic lives, including their engagement in online learning. Therefore, the current study sought to investigate adult learners’ perceptions and experiences about online learning as they combine learning situations with other family responsibilities. Specifically, the study answered the following research question:

What are the perceptions and experiences of adult learners about online learning in the era of COVID-19 in Ghana?

2. Theoretical Model

The current study is driven by the Technology Acceptance Model [TAM] as shown in Figure 1 (Davis, 1989).

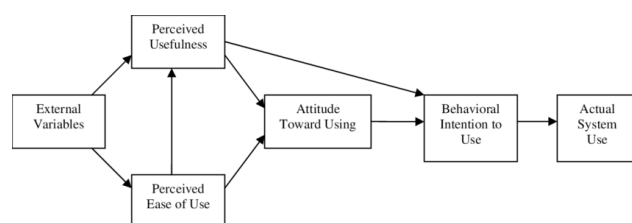


Figure 1. TAM.

The model is governed by diverse variables regarding technology in teaching and learning. According to TAM, an individual learner’s perception of the usefulness of technology in teaching and learning is dependent on how the individual learner perceives technology to be accessible to users. In TAM, an individual learner’s opinion on

the usefulness and ease of using technology in teaching and learning depends on external factors (social, cultural, and political factors). These external factors provide the basis for developing an appropriate attitude toward using technology. Once an appropriate attitude is established for the use of technology in teaching and learning, the individual learner might make behavioural intentions to apply technology in teaching and learning, which will influence the actual usage of technology in teaching and learning. Relating to the current study, adult learners’ perceived ease of the use of technology in learning will influence how they perceive technology to be useful as they anticipate no challenges and obstacles, their zeal to engage in learning through online platforms in the COVID-19 Pandemic increased. However, the interest in using online learning platforms becomes impossible without the influence of environmental events such as the availability of technologies, the possession of the required skills, the availability of competent online instructors that can mediate and guide the process of online learning. The appropriation and effectiveness of environmental events interacting with perceived ease of use and perceived usefulness of online learning platforms could influence the development of positive attitudes in adult learners towards the development of appropriate behavioural intentions to use online learning platforms and their actual usage and navigation of the online learning platforms.

3. Materials and Methods

The study was quantitative. Specifically, a descriptive design was employed. The design was chosen because it catered to various respondents from different geographical locations, pursuing postgraduate programs in Ghana. The quantitative descriptive design allows researchers to gather data from varied individuals at a particular time. According to Alexander, Lopes, Ricchetti-Masterson, and Yeatts (2015), the quantitative descriptive design simply characterizes the extent to which a phenomenon is evident in a specified population. In the current study, perceptions and experiences of the adult learners’ population served as the phenomena that have made it appropriate for the use of a quantitative cross-sectional survey design.

The study sought to profile adult learners’ perceptions and experiences about online learning, who by virtue of job and family demands might have issues with the 21st-century learning process. Based on this, the researchers surveyed 166 out of 3,155 adult learners pursuing postgraduate programs at the University of Cape Coast and the University of Education, Winneba. The respondents included both male ($n = 91$; 54.8%) and female ($n = 75$; 45.2%) adult learners but gender (biological differ-

ences) was not paramount in the data analysis. No specific sampling procedure was employed as all adult learners in these two universities were eligible to partake in the study, where the data were collected using Google Forms. The form was placed on the social media platforms of the adult learners for a period between 17th May 2021 to 22nd October 2022.

The data were gathered with an adopted perception scale with 14 items ($\alpha = 0.929$), which was scored on a 4-point Likert-type scale^[83]. The responses were scored according to strongly agree = 4, agree = 3, disagree = 2, and strongly disagree = 1. The scale was a standardised one, but pilot testing was conducted to ascertain the internal consistency, and as well, validity was satisfied. In terms of validity, convergent (where variables within a single factor are highly correlated), discriminant (where factors within a construct are distinct and uncorrelated) and construct validities were considered. For convergent validity, the Average Variance Extracted with a cut-off point of 0.25 and above with composite reliability of 0.6 and above were used as a basis^[84]. According to Fornell and Larcker^[84], in situations where AVE is less than 0.5, while composite reliability (CR) is higher than 0.6, the convergent validity of the construct is satisfied. The discriminant validity was established by finding the square root of the average variance extracted (AVE) value. Thus, $\sqrt{0.40}=0.632$, which is less than the composite reliability (CR) of 0.929, which implies that there are no problems of discriminant validity in the study^[85]. Based on convergent and discriminant outputs, it is evident that construct validity was satisfied.

The data collected were screened and cleaned using descriptive statistics to make sure all outliers were deleted so that they do not cause difficulty in model production. The analysis was performed using Structural Equation Modelling (SEM) enabled by SPSS-AMOS software 23. The use of SEM was not to ascertain and validate the construct or items but to establish the variance contribution of each item under the adopted scale. Therefore, a coefficient value of 0.250 and above was used as the minimum criterion^[86]. This implies that any value less than 0.250 is not accorded by the respondents but by the values above which align with their perceptions and experiences. In this study, the researchers followed all the protocols established by higher education institutions in Ghana. Specifically, the Institutional Review Board of the University of Education, Winneba gave clearance for the study to be conducted on 15th June, 2021.

4. Results

The study investigated perceptions and experiences of

adult learners concerning online distance learning in the advent of the COVID-19 Pandemic. First, adult learners' perceptions and experiences were ascertained using a 14 items online learning scale through CFA. The CFA provided results on fit indices such as Chi-Squared test, RMSEA, GFI, AGFI, RMR and CFI. With Chi-Square, it produced a significant value less than 0.05, which implies 'badness of fit', thus, $\chi^2(265) = 454.7$; $p = 0.000$ for the scale. The goodness of fit significant value for Chi Square was supposed to be greater than or equal to 0.05^[87]. Literature indicates that this particular index is sensitive to issues of sample size that could lead to the rejection of the model, where in this study; less sample size was used. Again, the significant chi-square results might be the reason this particular test assumes multivariate normality, as severe deviations from normality could lead to the rejection of the model even when the model is properly specified^[88]. Therefore, the results might not be exact based on the issues raised. The Root Mean Square Error of Approximation (RMSEA) was checked, which revealed that the model was moderate with a p-value of 0.065, which fell between 0.05 and 0.10 for continuous data and this indicated appropriate model fit^[87]. Furthermore, Goodness-of-Fit Index (GFI) and Adjusted Goodness-of-Fit Index (AGFI) were checked. The study revealed that GFI produced a value of 0.93, which is permissible according to Hair, Ringle, and Sarstedt^[87] and Tabachnick and Fidell^[89]. The AGFI produced a value of 0.89 greater than the cut-off points of 0.80^[90], which implies that the data produced a good model fit. Also, the Root Mean Residual (RMR) was checked, where it produced a value of 0.019, less than the cut-off point of 0.09, which implies a good model fit for the data^[91,87]. With the Comparative Fit Index (CFI), it produced a value of 0.90, which is a traditional value as it fell within the cut-off point of ≥ 0.80 and this implies the data had good model fits for most of the indices^[87]. Then after, the perceptions and experiences of adult learners were presented using coefficient values established with Confirmatory Factor Analysis (CFA). Table 1 presents the results:

Table 1 presents perceptions and experiences about online learning among adults who are compelled to upgrade themselves academically due to the immanent educational changes in Ghana. Based on perceived usefulness, respondents felt confident while using online learning content ($B = 0.272$, $p < 0.000$) and also accepted the fact that the online learning model provides them with the flexibility to study at a time convenient for theirs ($B = 0.266$, $p < 0.000$). However, respondents refuted those technologies are available to enable test taking and submission of assignments electronically and disagreed that online

Table 1. Perceptions and experiences of adult learners regarding online learning.

<i>SN</i>	<i>Statements</i>	<i>B</i>	<i>SE</i>	<i>P</i>
D1	Perceived Usefulness of Online Learning Platforms	$\alpha=0.685$		
1	Studying through an online learning model provides the flexibility to the study at the time convenient to me.	0.266	0.100	0.000
2	Online learning can enable me to study irrespective of where they are located.	0.240	0.082	0.000
3	There are technologies available to enable me to take tests and submit assignments electronically.	0.235	0.078	0.000
4	I feel confident while using online learning content.	0.272	0.115	0.000
D2	Perceived Self-Efficacy in Usage of Online Learning Platforms	$\alpha=0.886$		
5	I feel confident while operating online learning functions.	0.284	0.107	0.000
6	I feel confident while using online learning system.	0.274	0.115	0.000
7	There are electronic tools available to enable interactive communication between lecturers and myself without meeting face-to-face.	0.285	0.105	0.000
D3	Perceived Ease of Use of Online Learning Platforms	$\alpha=0.838$		
8	I believe online learning platforms are user friendly.	0.271	0.090	0.000
9	It would be easy for me to find necessary information when using an online learning platform.	0.267	0.080	0.000
10	I intend to use online learning to get updated on my subject knowledge with the latest amendments or changes.	0.252	0.114	0.000
11	I believe that using an online learning service can simplify the online learning process.	0.282	0.113	0.000
D4	Behavioural Intention of Using Online Learning Platforms	$\alpha=0.823$		
12	I intend to use online learning to assist my learning.	0.237	0.101	0.000
13	The set-up of the online learning service is compatible with the way I learn.	0.283	0.104	0.000
14	I intend to use online learning as an autonomous (free) learning tool.	0.286	0.116	0.000

**B*= Factor Loadings, *SE*= Standard Error, *P*=significant level

learning could enable them to study irrespective of their location.

Based on perceived self-efficacy in usage, it is overwhelming to report that respondents possessed the ability to engage themselves in learning situations using online platforms. For instance, electronic tools were available to enable interactive communication between lecturers and adult learners without meeting face-to-face ($B = 0.285$, $p < 0.000$), adult learners were confident while operating online learning functions ($B = 0.284$, $p < 0.000$), and as well, adult learners felt confident while using online learning system ($B = 0.274$, $p < 0.000$).

Based on perceived ease of use, it is worth noting that respondents felt the use of online learning platforms was easy. For example, it is reported that online learning service was believed to simplify the learning process ($B = 0.282$, $p < 0.000$), online learning platforms were perceived to be user-friendly ($B = 0.271$, $p < 0.000$), online learning is perceived to be easy for adult learners as it aids them in finding the necessary information ($B = 0.267$, $p < 0.000$) and adult learners accepted that the use of online learning get them updated their subject knowledge with the latest amendments or changes ($B = 0.252$, $p < 0.000$).

Based on the behavioural intentions of using online learning platforms, respondents indicated their intention to use online learning as an autonomous (free) learning tool and as well ($B = 0.286$, $p < 0.000$), accepted that the

set-up of the online learning services was compatible with their ways of learning ($B = 0.283$, $p < 0.000$) but refuted the fact that they intend using online learning platforms to assist their learning ($B = 0.237$, $p < 0.000$).

5. Discussion

Even though respondents indicated the unavailability of some aspects of online learning platforms that could enable them to take and submit an assignment, it is essential to note that they equally accepted the fact that they used online learning. The revelation implies that adult learners of HEIs in Ghana experienced and perceived online learning to be positive. This is corroborated by Aristovnik, Keric, Tomasevic, and Umek^[32]. In their study, it was found that learners possessed a higher level of conviction concerning perceived usefulness. With this revelation, adult learners of HEIs in Ghana stand the opportunity to reap the benefits of online learning provided the LMS are adequately and effectively offered to them. This is affirmed by Hrastinski's^[31] assertion that participation and application are intricately intertwined and that, for learners to reap the maximum benefit from participation, they must perceive it to be helpful with the overall participation experience.

Again, the study found that adult learners appeared to show self-efficacy in using online learning platforms. The findings imply that adult learners could use online learn-

ing platforms. In this sense, it is further training offered so that adult learners would appreciate and fully accept online learning at any time. The findings allude that adult learners had a good experience with online learning and had a positive perception of it. Above all, they possess high levels of perceived efficacy of online learning platforms. The perceived high levels of online learning efficacy could lead to the acceptance and use of online learning by adult learners in HEIs. Hoffman and Spataru^[37] indicated that learners with stronger self-efficacy outperform those with lower self-efficacy in online learning situations. Therefore, adult learners in HEIs surveyed in this study could better navigate online learning platforms when given the necessary guidance and resources.

Furthermore, adult learners who experienced and perceived online learning to be good believed that online learning platforms are easy to be used. The findings imply that adult learners in HEIs perceived online learning platforms as easy to use because they demand no physical presence of both instructors and learners, allowing learners to adjust and adopt learner-friendly changes. Furthermore, the findings imply that adult learners are likely to accept and use online learning platforms because they possess positive experiences and perceptions regarding ease of usage. The current study's findings re-echoed the study finding of Hortshorne and Ajjan (2009), which showed that the ease of use of online learning platforms had a favourable impact on their acceptance and participation. Furthermore, the positive perception and experience of the ease of using online learning platforms could influence learners' intention to continue using online learning platforms even after the COVID-19 Pandemic (Dalvi-Esfahani et al., 2018).

Finally, adult learners were behaviourally committed to using online learning platforms as they serve as free opportunities to navigate their learning situations. The findings show that adult learners are invigorated to use online learning platforms as free learning tools because they are compatible with how and how they learn. The findings imply that adult learners possess a positive attitude towards online learning platforms amid COVID-19; therefore, their attitude could influence their behavioural intentions to use online learning platforms. The findings support the assertions that a person's attitude regarding the use of online learning platforms directly impacts their behavioural intent to utilise online learning platforms Teo, 2011)^[58].

6. Conclusions

They investigated adult learners' perceptions and experiences concerning online learning amid the COVID-19

Pandemic. The study found that adult learners had a good perception of online as they perceived online learning to be beneficial to their academic growth and progress. The findings imply that the respondents shared varied perceptions and experiences because they see online as useful in some situations, but some aspects of the process are untenable. Based on the conclusion, the researchers recommended that higher education institutions in Ghana should prioritise online learning among their students as this mode of learning goes beyond the period of COVID-19. Through online learning, the quality of education could be improved, and at the same time, the institutional market share of student numbers could increase. Again, higher educational institutions in Ghana should make it a mandate to provide the necessary equipment and access to their students to use the various online learning platforms provided fruitfully. This is important because the study found that some of the necessary technological equipment was unavailable for students' work, such as tests and examinations. It is important to note that the success of every online learning situation depends on the availability of equipment and its accessibility; hence their equipment availability and easy access will go a long way to help champion the course of every competitive higher educational institution in 21st-century education.

Limitation

The study is limited in scope and sample size because only adult learners were recruited for the survey. Therefore, generalizability and the drawing of implications from the study findings should be executed with caution.

Conflict of Interest

The authors have no interest to declare.

Data Availability

The data used for this study is available and sharable when a formal request is made to the authors.

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