

The Relationship Between Cumulative Ecological Risk and Adolescent Cyberbullying: the Mediating Effects of Rumination and Cybervictimization

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Abstract

This study explored the mechanism of cyberbullying, the independent mediating effect of rumination and cybervictimization respectively, and the chain mediation effect of rumination and cybervictimization based on the theory of cumulating ecological risk. 1510 junior high school students (mean age:15.2, standard deviation: 1.41, age range: 13–17) were adopted to fill with the Cyberbullying/Cybervictimization Questionnaire, the Cumulative Ecological Risk Scale, the Rumination Scale. And we tested the correlation among the four variables, namely rumination, cybervictimization, cumulative risk, and cyberbullying. The chain mediating effect of rumination and cybervictimization between cumulative ecological risk and cyberbullying was modelled as well. The results revealed that: (1) cumulative ecological risk had a significant positive predictive effect on cyberbullying behaviour with controlling for grade and gender. (2) Cybervictimization mediated the relationship between cumulative ecological risk and cyberbullying; (3) Rumination and cyber-victimization play a chain mediating role in the relationship between cumulative ecological risk and cyberbullying.

1. Introduction

Over the past decade or two, more and more adolescents in China have gradually gained frequent access to the Internet, due to the result of the continuous development and improvement of communication technologies. According to the 47th Statistical Report on the Development of the Internet in China released by the China Internet Network Information Centre (CNNIC) on 3 February 2021, the number of Chinese Internet users has reached 984 million in December 2020, which counted for 70.4% of the country's entire population. Over 50% of the users were aged under 40. Students, which was the largest user group, accounted for 21.1% of the entire Internet user population in China (CNNIC, 2021). From the data, it is clear that more middle school students have gained access to the Internet and electronic devices for their daily communication. Thus, bullying, which once took places face to face, has now expanded into the virtual space. A new form of bullying, which is known as cyberbullying, has emerged.

Cyberbullying is an extension of traditional bullying on the Internet (Smith, 2010). It is defined as a series of prolonged and repeated deliberate aggression by a group or individual against another through a virtual space, e.g., the Internet, where it is often difficult for the victims to defend themselves. The victims of cyberbullying are usually peers of the persecutors, e.g., schoolmates and classmates. Typically, the victims are not fully developed physically or mentally. Such bullying can cause tremendous mental harm, which could be an obstacle for them to develop healthy personalities and may even make ineradicable changes to their grown-up lives. Research has shown that during cyberbullying, both the persecutors and the victims may experience a variety of problems, e.g., becoming suicidal, depressed, and anxious, feeling an increasing level of loneliness, drug and alcohol abuse, reduced life satisfaction, and having lower self-esteem and lower academic performances (Fu et al., 2020; Mitchell et al., 2018; Kowalski et al., 2012). Therefore, many researchers have argued that it is necessary to explore the internal mechanisms, to provide theoretical support, and thus prevent and intervene in adolescent cyberbullying.

1.1. The relationship between Cumulative Ecological Risk (CER) and adolescent cyberbullying

Most of the research on the antecedents of cyberbullying has explored a single factor with little consideration of the whole picture. However, the Bioecological Theory (BT) (Bronfenbrenner & Morris, 1998) suggested that human development is influenced by a variety of ecosystems, including family, peers, school, and community. An extensive amount of BT based research on these factors revealed that these factors do play very important roles in adolescent cyberbullying (Zhang & Wu, 2017). Masten et al. (2014) pointed out that the harm to the development of individuals is often left undiscovered when only a single factor is present. As the risk factors accumulate, their development may be exposed to an extreme degree of harm and impairment. In addition, the external risk factors do not act independently of each other. Instead, they act highly simultaneously, interactively, and the correlations between these factors are highly complicated (Xi & Zuo, 2009). Some researchers have hence proposed the concept of Cumulative Ecological Risk (CER), arguing that it is crucial to pay more attention to the risk factors in multiple domains during the research process. It portrays the reality of individual developments within the current situation better when examining the impact through cumulating risk factors (Li et al., 2016). In previous research, it is found that negative family environments (Moreno-Ruiz et al., 2019; Ybarra & Mitchell, 2004), poor peer relationships (Coelho & Marchante, 2018; Harris, 2009), negative school environments (Zheng et al., 2017; Esther et al., 2010), as well as the social environment have an impact on the emergence of cyberbullying (Menard et al., 2015; Wright et al., 2013). Similarly, cyberbullying brings both the persecutors and the victims a varying degree of negative impact (Quintana-Orts et al., 2020; Camerini et al., 2020; Turliuc et al., 2020; Peled, 2019; Chu et al., 2018).

In his Moral Disengagement Theory, Bandura suggested that when individuals are exposed to a relatively highly stimulating environment for a prolonged period, they are prone to a decreased self-control ability and an increased possibility of acting impulsively and exhibiting aggressive behaviour online. To sum up, in this study, it is hypothesised that CER could positively predict adolescent cyberbullying (Hypothesis 1).

1.2. The independent mediating effect of Rumination

Researchers have rarely explored the internal mechanisms of the relationship between CER and cyberbullying. According to the General Strain Theory, individuals who are exposed to multiple stressors are prone to negative emotions, e.g., anger and frustration, which inevitably increase their incidence of having deviant behaviour and the likelihood of committing violent crimes counteracting the stressor (Agnew, 1992). The Stress-Reactive Rumination Model (Robinson & Alloy, 2003) suggested that the underlying cause of Rumination is the various stressful events experienced by individuals. RUMINATION refers to the process that individuals are focused on the causes and consequences of their own negative emotions, thoughts, or behaviour repeatedly and uncontrollably, instead of actively finding ways to ameliorate the situation. They have lost the ability to extricate from their negative thoughts. Hence, some scholars suggested that Rumination is essentially a style of response to maladaptation (Nolen-Hoeksema, 1991).

According to the point of view of the Cognitive Load Theory (Chen & Feng, 2015; Watkins & Brown, 2002), the main reason for individuals to develop Rumination is the negative and difficult events they have encountered or encountering, in their daily lives. These events can occupy a large portion of their limited cognitive resources, which are supposed to be linked to their thoughts and behaviour. If one's cognitive resources are over-occupied, it is inevitable that his or her executive and self-controlling abilities would be undermined. This leads to a failure of self-regulation, an increased level of activity, and a decreased range of attention, thus igniting their aggressive behaviour. As a negative way of thinking, Rumination forces individuals to focus solely on the negatives, draining their willpower and the ability to adapt (Nolen-Hoeksema, 2008). At the same time, Rumination not only impairs their problem-solving abilities or their access to social support but also amplifies their suicidal thoughts (Liu et al., 2014). Besides, research has shown that Rumination is also associated with individuals' maladaptive behaviour. It has been found to be a variable that provides powerful and effective predictions of aggressive behaviour on the Internet and adolescent violence (Jin et al., 2018; Garcia-Sancho et al., 2016). Therefore, Rumination is a major reason for adolescent students to develop aggressive behaviour (Eisenlohr-Moul et al., 2016; Peters et al., 2015; McMahon et al., 2010). In addition, studies have shown that Rumination acts as a mediating variable for the relationship between cybervictimization and depression (Pasquale et al., 2021; Zhong, Lai & Tang, 2015; Feinstein et al., 2014), as well as that of relational aggression and depression (Mathieson et al., 2014). Based on the above, in this study, it is hypothesised that Rumination has a mediating effect on the relationship between CER and adolescent cyberbullying (Hypothesis 2).

1.3. The independent mediating effect of cybervictimization

As Bandura advised in his Social Learning Theory, all kinds of behaviour can be learned directly or through imitation. Therefore, the acquisition of aggressive behaviour is also closely linked to the experience of being bullied frequently. Research on cyberbullying persecutors' experience has shown that the following factors could be used to effectively predict adolescent cyberbullying behaviour: a record of participating in traditional bullying as either a persecutor or a victim (Yang et al., 2013), commanding and authoritative parents (Makri-Botsari & Karagianni, 2014), a close relationship with peers who break the laws and have no public morals (Hinduja & Patchin, 2013), a low sense of belonging when at school (Wong et al., 2014), and frequent contact with violent media (Den Hamer & Konijn, 2015). On the other hand, for cyberbullying victims, frequent exposure to cyberbullying is also likely to trigger their aggressive and lawless behaviour (Cassiani-Miranda et al., 2021; Chandrashekar et al., 2016). Studies have found that some people play a dual role during cyberbullying events (i.e., they could be both the persecutors and the victims at the same time) (Lee & Shin, 2017; Zhou et al., 2013; Vandebosch & Van Cleemput, 2009). Reemst et al. (2016) suggested in their research that if individuals are constantly bullied, their social information processing models would be altered in such a way that they would perceive bullying as permissible or even justifiable. In addition, cybervictimization is considered to be the second most important predictor of cyberbullying events (Kowalski et al., 2014), as individuals would choose to fight back correspondingly if they are bullied on the Internet (Francine et al., 2008). However, in a follow-up study by Barlett and Gentile (2012), a significant bidirectional predictive effect was found between cybervictimization and cyberbullying. Based on the above, in this study, it is hypothesised that CER and

Rumination could positively predict adolescents cybervictimization, cybervictimization could positively and directly predict adolescent cyberbullying, and cybervictimization has a mediating effect on the relationship between CER and cyberbullying.

1.4. The serial mediating effects of Rumination and cybervictimization

In this study, Rumination and cybervictimization serve as two mediating variables. It is found in previous studies that Rumination is particularly positively correlated with cybervictimization (Pan, 2020; Quintana-Orts et al., 2020; Camerini et al., 2020; Feinstein et al., 2014). As a negative and pessimistic way of thinking, Rumination could cause individuals to be more vulnerable when participating in social activities (Valkenburg & Peter, 2007). In addition, according to the Response Style Theory, Rumination is often a precursor of depression, which means that the incidence of depression increases accordingly if Rumination takes place more frequently (Yang & Liu, 2016). Cybervictimization, on the other hand, is found to be able to positively predict the occurrence of depression (Chu et al., 2018) as it reinforces the negative emotions of individuals. Thus, it is noticeable that these two variables are somewhat antagonistic. External CER factors reinforce individuals' Rumination, causing them to become even more disengaged from social activities. As targets of other violent individuals or groups, they are prone to cybervictimization, which can be even more severe than traditional face-to-face bullying. Affected by multiple sources of pressure, an individual is more likely to think and behave negatively, and this could cause his or her role as a victim in cyberbullying events to shift to that of a persecutor.

In summary, the effects of CER on adolescent cyberbullying is intended to be discussed in this study, along with the details (i.e. the independent and serial mediating effects of Rumination and cybervictimization). Please refer to Chart 1.4 for model specifications. It is hoped that the study will shed light on the internal mechanisms of CER affecting cyberbullying and provide the adolescents with more beneficial suggestions of stopping Internet misuse and easing their psycho-emotional burden

2. Methodology

2.1. Subject selection

Subjects were recruited in groups of class from middle schools in Jingzhou, Hubei and Southwest Guizhou Autonomous Prefecture, by employing a random sampling method. The test was then centrally administered, and the total number of valid responses collected was 1510 (mean age: 15.2, standard deviation: 1.41, age range: 13–17). 815 (53.96%) were from girls and 694 (45.96%) were from boys. There was one person who did not reveal their gender. The numbers and percentages of students from different grades are shown in Table 2.1-1 and Chart 2.1-2. There were 6 students (0.4%) who did not disclose the grades that they were in.

2.2. Tools used for the test

The Adolescent Cyberbullying Questionnaire, the Cumulative Ecology Questionnaire, and the Rumination Scale are used. In particular:

2.2.1 The Cyberbullying/Cybervictimization Questionnaire (CBQ/BCBQ) for Middle School Students

CBQ/BCBQ (Lam & Li, 2013) consists of 12 questions, with questions 1 to 6 on 'Cyberbullying' and questions 7 to 14 on 'Cybervictimization'. A 7-point Likert scale was applied for marking. An answer of '0 time' would have received a score of 0, and that of '6 times or more' would have received a 6. A higher total score indicates a higher frequency of bullying or being bullied. In addition, research has shown that the Chinese version of the scale has also shown high reliability and validity when applied to Chinese adolescents (Lam & Li, 2013). In this study, the overall Cronbach's coefficient for the scale returned 0.935, and the respective coefficients of cyberbullying and cybervictimization were 0.89 and 0.925.

2.2.2 The Cumulative Ecological Risk (CER) Questionnaire

This questionnaire is based on the Bioecological Theory (BT) and draws on previous research on CER. Four subsystems of the ecological environment were selected, viz. family, peer, school, and community. Specifically, the 10 most representative risk factors were included in a questionnaire that contained a total of 55 questions, to construct an index of CER. The 10 risk factors are:

1. Parents' education levels. Based on previous research, the parents' education levels of the subjects were recorded using two separate items (Gerald & Buehler, 2004). A 7-point Likert scale was used. A response of "No Schooling Completed" would have received a score of 1, and that of "Master's Degree or Above" would have received a 7. The scores range from 1 to 7.
2. Family type. Paying homage to a previous study (Bao, 2014), a single item was used to collect information on the subjects' family members: "Who are the family members living with you now (Select all that apply)?" The options are: "Biological Father", "Biological Mother", "Stepfather/Foster Father", "Stepmother/Foster Mother", "Paternal Grandparent(s)", "Maternal Grandparent(s)", "Sibling(s)", and "Other(s)".
3. Financial hardship. The Economic Stress Questionnaire from a previous study (Wang et al., 2010) was used. The questionnaire consists of four items and uses a 5-point Likert scale for scoring. A response of "Never" would have received a score of 1, and that of "Always" would have received a 5. A higher final score indicates to a higher extent the subject is having a financial hardship. This method is in line with common statistical standards (Evans, Li & Whipple, 2013) and is also a common empirical standard used in similar studies. In this study, the Cronbach's coefficient returned was 0.834.
4. Parent-child relationship. A modified version of the Parent-Child Relationship Questionnaire was applied for measuring, which consists of seven items, including the following 7 indicators from the Social Network Questionnaire (Furman & Buhrmester, 1985). The indicators are emotions, intimacy, instrumental

helping, value affirmation, companionship, worries, and conflicts. These are all closely related to the parent-child relationship. A 5-point Likert scale was used. A response of "Never" would have received a score of 1, and that of "Always" would have received a 5. The higher the total score, the better the parent-child relationship of the subject. The Cronbach's coefficient returned was 0.65 in this study.

5. Parents' spousal relationship. Two items were used to measure the parents' spousal relationship of the subject, referencing previous research (Bao et al., 2014). A 5-point Likert scale was used. A response of "Very Poor" would have received a score of 1, and that of "Very Good" would have received a 5. The higher the total score, the better the relationship between the parents of the subject. The Cronbach's coefficient returned was 0.30 in this study.

6. Friend support. The Friend support Sub-Scale from the revised version of the Perceived Social Support Scale (PSSS) was used (Jiang, 1999). The questionnaire has three items and is scored on a 5-point scale, from 1 for "Never" and 5 for "Always". The higher the total score, the more supportive the subject perceived their friends to be. The Cronbach's coefficient returned was 0.65 in this study.

7. School-to-home connection. The School Connections Questionnaire (Resnick et al., 1997), a five-item questionnaire developed by previous researchers, was used. A 5-point Likert scale was used. A response of "Strongly Disagree" would have received a score of 1, and that of "Strongly Agree" would have received a 5. The higher the total score, the higher the perceived level of connectedness of the subject between his/her home and his/her school. In this study, the Cronbach's coefficient returned was 0.76.

8. Community safety. The overall assessment of community safety was based on previous research (Gerald & Buehler, 2004) using a single item: "I feel safe where I live". A 5-point Likert scale was used. A response of "Strongly Disagree" would have received a score of 0, and that of "Strongly Agree" would have received a 5. The higher the score, the safer the subject perceives the community to be.

9. Neighbourhood support. Based on the study by Zhenyu Bao (2014), two items were used to measure neighbourhood support: "I know my neighbours well," and "My neighbours are always there to help when my family is in need." The items were scored on a 4-point and 6-point Likert scale, respectively. For the first question, a response of "There is no neighbour around" would have received a score of 0, and that of "I am familiar with all of them" would have received a 4. For the second question, a response of "They are always there to help" would have received a 6. The higher the total score, the higher the perceived neighbourhood support. The Cronbach's coefficient in this study was 0.62.

10. Adolescent life events. The Adolescent Life Event Stress Scale (ALESS) was used (Liu et al., 1997). The 27-item questionnaire measures the stressful life events experienced by the subjects in the past 12 months, e.g., "being misunderstood or wronged", and the extent to which the stressful life events have affected them personally. A 6-point Likert scale is used. A response of "Not Happening" would have received a score of 1, and that of "Extremely" would have received a 6. A higher total score indicates that a larger amount and higher severity of the stressful life events that the subjects have encountered in the past 12 months. The Cronbach's coefficient for this was 0.93.

2.2.3 When treating the above ten risk factors referencing previous research (Bao et al., 2014), it is necessary to code the total scores of each factor. The codings are shown in Table 2.2.2. All ten coded risk scores of each subject were summed up to give a CER index, which represents the total score of the risk factors experienced by that subject. The overall Cronbach's coefficient was 0.792.

2.2.4 The Rumination Scale (RS)

The Rumination Scale (RS) (Han & Yang, 2009) is a 22-item scale, marked by using a 4-point Likert scale. A response of "Never" would have received a score of 1, and that of a "Sometimes" would have received a 4. The higher the total score, the higher the subject's level of Rumination. The Cronbach's coefficient was 0.94 for this scale.

2.3. Data processing

The data was analysed using IBM SPSS 21.0 with missing values filled by mean imputation. The bias-corrected bootstrap process was repeated for 5000 times using SPSS macro program PROCESS, then Model6 was applied to test the mediating effects.

3. Result Analysis

3.1. Testing for common method bias

Harman's Single Factor Test (Zhou & Long, 2004) was applied with a general factor of 1. The results showed that there were 23 factors with eigenvalues greater than 1, with a maximum eigenvalue of 9.819 and a maximum explained variance ratio of 11.157%. It means that, in this study, there are no factors with excessive explanatory power, and thus there is no serious common method bias.

3.2. Correlation analysis of Cumulative Ecological Risk (CER), Rumination, cybervictimization, and cyberbullying

The summary statistics and related analysis are shown in Table 3.2. The results showed that all variables were significantly and positively correlated with each other 0.01. The absolute values of those statistically significant correlation coefficients between the variables ranged from 0.164 to 0.73.

3.3. Testing the serial mediating effects of Rumination and cybervictimization between the relationship of Cumulative Ecological Risk (CER) and cyberbullying

The mediating effects of Rumination and cybervictimization in the relationship between CER and cyberbullying were examined using Model6 (the serial mediation model) macro program developed by Hayes (2013), controlling for gender and grade. As shown in Table 3.3-1, CER is a direct positive predictor of Rumination 0.27, 0.001 and cybervictimization 0.176, 0.001. Rumination is a direct positive predictor of cybervictimization 0.154, 0.001. When CER, Rumination and cybervictimization were used simultaneously to predict cyberbullying, CER and Rumination showed no significant predicting powers 0.0216, 0.243 but CER and cybervictimization did 0.703, 0.001. Also, CER, Rumination, and

cybervictimization was significant as a whole for predicting cyberbullying 0.037, 0.05. Please refer to Chart 3.3-2 for a more detailed illustration of the relationship between CER and adolescent cyberbullying.

As shown in Table 3.3-3, the mediating effect was further tested by non-parametric bootstrap with correction for bias. The results revealed significant mediating effects of Rumination and cybervictimization with a value of 0.159. Typically, mediating effects can be generated through three chains of mediation (shown in Table 3.3-3). However, one of the chains did not hold according to the test results, which is the chain Ind1 shown in Table 3.3-3 since its bootstrap 95% C.I. contains 0.

4. Discussion

This study shows that adolescent CER, Rumination, cyberbullying and cybervictimization are significantly correlated with each other. It indicates that CER does hurt the development of adolescents' thinking patterns and it acts as a thrust in the emergence and the evolving process of their deviant behaviour. It is consistent with previous studies (Wang et al., 2020; Fan & Miaomiao, 2018; Jiang et al., 2013). The results of this study have theoretical and practical implications for deepening research on the relationship between CER and individual psychology and misbehaviour, as well as for guiding our educational authorities and parents to create a positive external environment for adolescents.

4.1 The relationship between Cumulative Ecological Risk (CER) and adolescent cyberbullying

This study finds that CER could generate significant and positive predictions on adolescent cyberbullying, which is not only consistent with Hypothesis 1 but also with previous research findings (Yang et al., 2020; Tan et al., 2020; Wright & Masten, 2005). Adolescent students are at a stage of rapid physical and psychological development. In this era of the Internet and data explosion, while the Internet has brought benefits to their personal development, it has also seduced some adolescents to overindulge in online violence. The lack of a positive external environment allows them to become overly sensitive and makes them unconsciously fall into complex emotions. This would make their bad behaviour on the Internet even worse. It has been suggested that these external risk factors during adolescence will remain in their memories for a long time, and the adolescents will implicitly acquire the paradigm of cyberbullying (Jin, 2018). When adolescents are in an environment that induces bullying behaviour, they are highly likely to display the corresponding cyberbullying paradigm and harm others.

Also, according to the General Aggressive Model, the emergence of adolescent cyberbullying behaviour is associated with input variables in the external environment (e.g., financial difficulties, parent-child relationship, parents' spousal relationship, the ambience of the school, and friend support) and the information processing patterns of the individuals (Rumination, etc.) (Dewal et al., 2011). Therefore, it can be argued that when adolescents are exposed to a prolonged period in a negative external environment, the more stress they feel, the more risks are they putting on their mental health. The risks

are also likely to exacerbate the emergence of deviant or violent behaviour. It is therefore important to explore ways to improve individual surroundings to reduce cyberbullying among adolescents.

4.2 The independent mediating effect of Rumination

In this study, Rumination shows no significant mediating effect on the relationship between CER and cyberbullying, and therefore Hypothesis 2 is rejected. In previous research, Rumination has displayed a partial mediating effect between the relationship between negative life events and cyberbullying, which can positively predict cyberbullying (Sun, 2018). Rumination can also partially mediate between perceived chronic social adversity and cyberbullying (Jin et al., 2020). Therefore, during the data analysis processes in the present study, the “negative life events” category in CER was considered to be treated as an independent variable. The results have revealed that Rumination has a mediating effect between “negative life events” and cyberbullying with an indirect effect value of 0.34 (95% C.I. = [0.0064, 0.0234]). This is consistent with previous research, suggesting that this study is based on previous research and that the data is valid. Besides, it is noted in previous research results that virtually all ecological factors could be taken into account when measuring CER. However, considering the preciseness, necessity and feasibility of the research, it is more important to consider the risk factors that are closely related to the emergence, developmental process and the outcomes (Li et al., 2016). When measuring the mechanisms of the factors impacting adolescent misbehaviour, most of the studies have considered those ecological risk factors which are more 'negative' (Tan et al., 2020; Li et al., 2016), e.g., connections with peers who constantly break the laws and have little public morals, alienated with parents, peer aggression, parental rejection, marital conflicts between parents. It may be therefore more appropriate to select the ecological risk factors which are more relevant when exploring the mechanisms of adolescent cyberbullying. It also suggests that it is needed to reconsider and reselect the factors that are highly feasible and necessary, not only in the present study but also in the future ones.

4.3 The independent mediating effect of cybervictimization

Although Rumination is not playing the independent mediating role in the relationship between CER and cyberbullying, further results show that, compared to the mediating effect of Rumination on the relationship between CER and cyberbullying, the effect value is larger when Rumination and cyberbullying are simultaneously included as serial mediating factors (as shown in Table 3.3-3). In addition, few studies have included cybervictimization as a mediating variable in the relationship between CER and cyberbullying, and this is where this study is innovative. It is found in previous research that there is a periodical shift between cyberbullying and cybervictimization. Therefore, adolescents who started cyberbullying, or acted as persecutors, are more likely to become victims of cyberbullying events at other times (Hamer et al., 2014; Slonje et al., 2013). Compared to traditional bullying, cyberbullying is a more turbulent and fluid process as the role an individual plays would change constantly and become hard to differentiate (Hamer et al., 2014; Desmet et al., 2014). For example, adolescents who experience cyberbullying may start another round of cyberbullying for retaliation, which in turn leads them to be more vulnerable to cyberbullying (Patchin & Hinduja, 2010). As we all know, online ‘interaction’ is about the communication between the two, thus adolescents could be traumatised both mentally and

physically when in stressful external environments or experience cyberbullying, and it is easy for them to change their roles as victims to persecutors.

4.4 The serial mediating effects of Rumination and cybervictimization

In this study, Rumination and cybervictimization have serial mediating effects on CER acting on adolescent cyberbullying. It is found that CER could influence adolescent cyberbullying through the effects of certain mediating variables. Research has shown that Rumination and cyber morals play mediating roles in the relationship between exposure to violent environments and online aggressive behaviour among college students (Jin et al., 2018). Cyberbullying could be significantly predicted after being bullied for three months (Wang, 2020). In a longitudinal study controlling for gender and cyberbullying behaviour six months prior, the results have shown that verbal and relational cyberbullying six months thereafter could be predicted significantly and positively by cybervictimization (Brett & Faye, 2018; Wright & Li, 2013). Therefore, it is inferred that adolescents could be stuck in the stressful circle when facing pressure from the external environment, which could exacerbate their Rumination. Combined with the fact that experiencing cyberbullying itself amplifies the deviation of their thoughts, this will increase their likelihood of misbehaving. The more stressful the external environment is for adolescents, the less socially competent they become (Corapci, 2008; Valkenburg & Peter, 2007). Under these circumstances, adolescents would still use the Internet to communicate at an even higher frequency, which inadvertently exposes them to the risk of cyberbullying. It can be seen that CER could predict cyberbullying to some extent. At the same time, Rumination brings obstacles to adolescents developing their social competency and thus causes their interpersonal skills to decline (Dickson et al., 2017; Whitmer & Gotlib, 2013). Therefore, it is easy for adolescents to develop hostile perceptions of others when interacting. Due to the nature of invisibility and virtuality of the Internet, they project their real-life stresses upon strangers online and pull the trigger of cyberbullying (Guerra & White, 2017; Eisenlohr-Moul et al., 2016; García-Sancho et al., 2016).

5. Implications & Deficiencies

The serial mediation model reveals the cognitive mechanisms (Rumination and cybervictimization) of adolescent aggressive behaviour resulting from cyberbullying. The model responds to the question of how the external environment influences adolescent cyberbullying and also answers that of how CER directly predicts cyberbullying and how Rumination and cybervictimization play their mediating roles. The study has positive implications for deepening research on the relationship between cyberbullying and individual psychology, behaviour and the external environment.

However, the implications of the study come with some deficiencies. Firstly, some schools and students were reluctant to participate in this survey due to the sensitivity of the topic of 'bullying'. After analysing the responses after the questionnaires were collected, it was found that a portion of the responses have deliberately exaggerated the severities of them 'being bullied' and hid the fact that they were bullying or

had others bullied. Secondly, the chain of CER → Rumination → Cyberbullying is insignificant, which should be, according to previous research. This is noteworthy and the reason behind this remains to be explored. Thirdly, this study is of a cross-sectional design, which has limitations when exploring the causal relationships between variables. Since CER is considered to be a variable that is constantly changing, future studies should adopt a longitudinal design to explore the relationship between CER and adolescent cyberbullying. Fourthly, the responses collected using the questionnaires were with strong concealments due to the nature of the topic of cyberbullying. Therefore, the data collected may be more credible if the experiments are designed and carried out implicitly in the future.

6. Conclusion

To sum up, the following conclusions are drawn from this study:

1. The four variables, viz. CER, Rumination, cyberbullying, and cybervictimization, have all shown significant positive correlations with each other.
2. CER has a significant positive influence on adolescent cyberbullying and thus could be used to positively predict cyberbullying behaviour among adolescents.
3. Cybervictimization can indirectly influence CER and adolescent cyberbullying by playing a partially mediating role.
4. CER can have an effect on adolescent cyberbullying through the serial mediating effects of Rumination and cybervictimization.

Declarations

Ethics approval and consent to participate

This research was reviewed and approved by the Ethics Committee of Faculty of Psychology, Yangtze University.

All participants signed the informed consent form.

Consent for publication

All authors agree with the publication.

Availability of data and materials

All data and materials were available.

Competing interests

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of the manuscript entitled.

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Authors' contributions

LIU Yifan, Xiong Gan, and Rong Liu wrote the main manuscript text and LIU Yifan prepared all figures and tables. Xin Jin and Congshu Zhu collected the data. All authors reviewed the manuscript.

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Tables

Table 2.1.1
Distributions of the Grades

Grade	Count	Percentage
7	160	10.6%
8	539	35.7%
11	452	29.9%
12	353	23.4%
N/A	6	0.4%
Total	1510	100.0%

Table 2.2.2
Coding Criteria for the Risk Factors

Risk factor	Criterion	Code
1	Both parents' education levels are of "High School Diploma" or below	1
2	The subject is not living with at least one of his/her biological parents	1
3 & 10	Score percentile 75%	1
4, 5, 6, 7 & 9	Score percentile 25%	1
8	A response of "1 (Strongly Disagree)" or "2 (Disagree)"	1
<p>Note: Being coded as 1 indicates that the subject who provided this response is to be considered as under the risk of this particular risk factor. The responses which did not meet the criteria would be coded as 0, indicating that the subject who provided the responses is not under the risk of this particular risk factor.</p>		

Table 3.2
Summary Statistics and Related Analysis (N = 1510)

	M	SD	1	2	3	4
1 CER	3.54	1.88	-			
2 Rumination	48.29	13.2	0.261**	-		
3 Cybervictimization	3.89	6.35	0.249**	0.190**	-	
4 Cyberbullying	1.87	5.24	0.222**	0.164**	0.730**	-
<p>Note: *p < 0.05, **p < 0.01, ***p < 0.001. Applicable to all tables, charts and data hereinafter.</p>						

Table 3.3.1
Regression Analysis of the Relationship Between Variables

Regression Equations		Overall Fit Indices			Significance of Regression Coefficients	
Result Variable	Predicted Variable	R	R ²	F	β	t
Cyberbullying	Gender	0.32	0.1	58.49***	-0.11	-2.19**
	Grade				-0.12	-9.36***
	CER				0.20	6.65***
Rumination	Gender	0.28	0.08	43.7***	0.21	4.28***
	Grade				0.02	1.43
	CER				0.27	10.8***
Cybervictimization	Gender	0.39	0.15	67.92***	-0.19	-3.92***
	Grade				-0.14	-10.86***
	CER				0.18	7.11***
	Rumination				0.15	6.23***
Cyberbullying	Sex	0.734	0.54	351.35***	-0.0028	-0.08
	Grade				-0.03	-2.84**
	CER				0.04	1.97*
	Rumination				0.02	1.17
	Cybervictimization				0.70	36.96***

Note: The data was standardized for all variables.

Table 3.3-3 - The Serial Mediating Effects of Rumination & Cybervictimization Between CER & Cyberbullying

		Mediating Effects		95% C.I. Upper bound	95% C.I. Lower bound	Relative Mediating Effects
	Total Indirect Effects	0.159	0.0232	0.1145	0.2067	81%
Ind1	CER → Rumination → Cybervictimization → Cyberbullying	0.0058	0.0072	-0.0076	0.0203	
Ind2	CER → Cybervictimization → Cyberbullying	0.1241	0.0232	0.0803	0.1721	63%
Ind3	CER → Rumination → Cybervictimization → Cyberbullying	0.0292	0.0069	0.0165	0.0437	15%

Figures

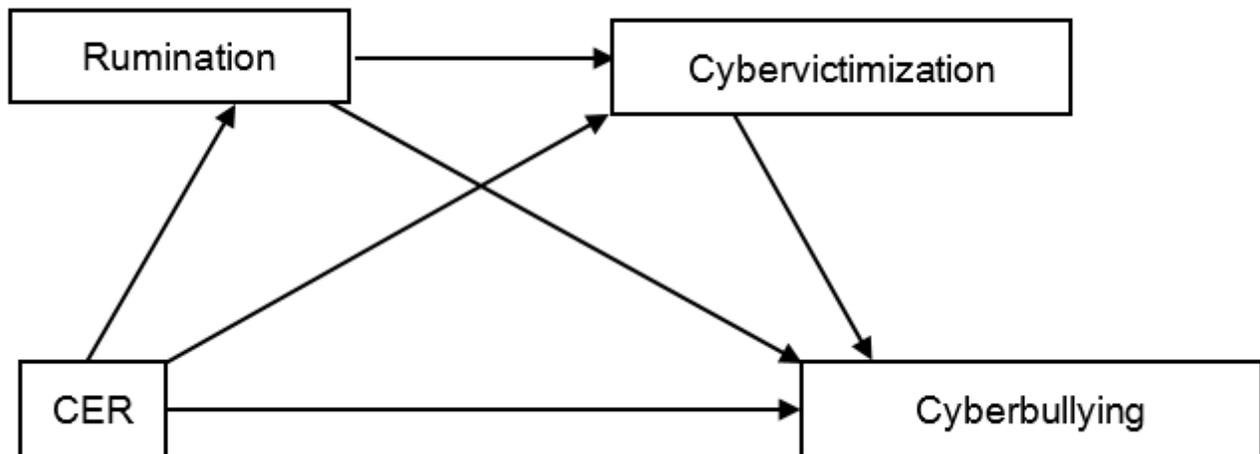


Figure 1

A Simple Illustration of the Hypothesised Model:

The Serial Mediating Effects of Rumination and Cybervictimization

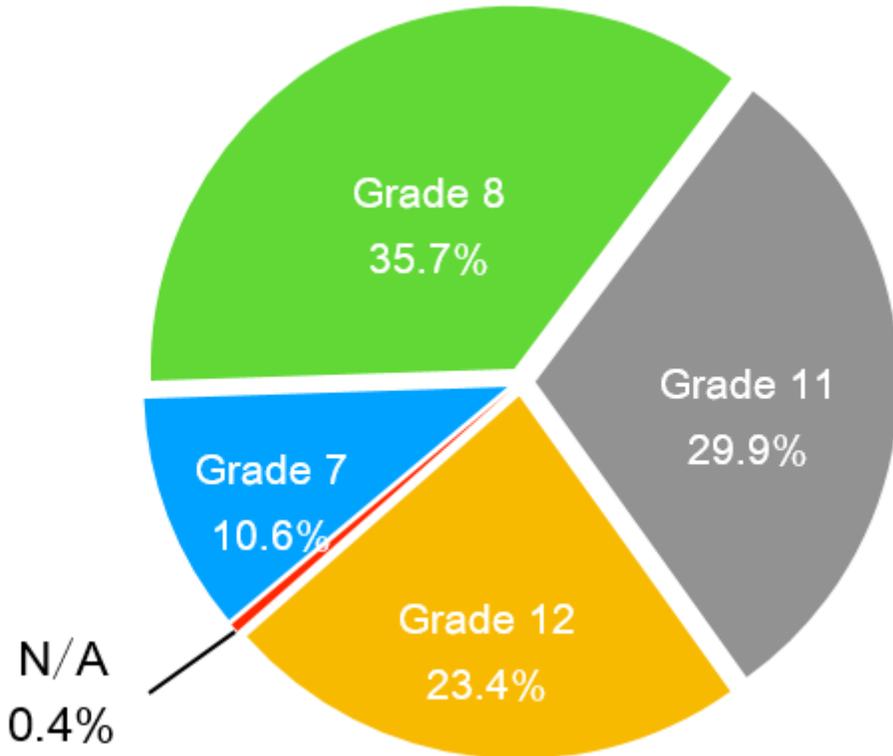


Figure 2

Grade Percentage Visualisation

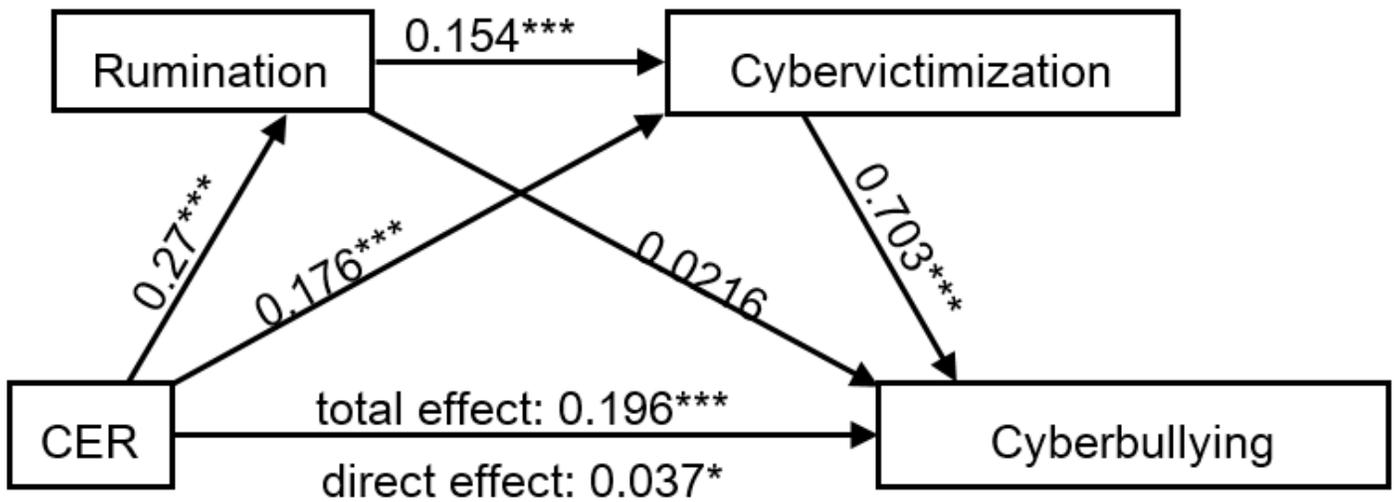


Figure 3

The Hypothesised Model with

Values Returned from the Test:

The Serial Mediating Effects of Rumination and Cybervictimization