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<https://doi.org/10.1057/s41599-023-01695-x>

OPEN

Integrated macro and micro analyses of student burden reduction policies in China: call for a collaborative “family-school-society” model

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The ultimate goal of China’s student burden reduction policy is to promote quality education, which is also the core task of UNESCO’s Sustainable Development Goal for education (SDG 4). China aims to achieve quality education development through continuous implementation of student burden reduction policies. However, no previous studies have simultaneously explored the macro-level dynamic changes and micro-level stakeholders’ (parents) views regarding the implementation of student burden reduction policies. Here, we examined 232 policy documents from 1951 to 2021 and analyzed 23,567 parents’ responses to a questionnaire survey across 29 provinces to obtain holistic insight into student burden reduction policies. We found that student burden reduction policies followed the form “Central leadership + Ministry of Education sovereignty + multi-department coordination”, while parents received relatively little attention. There is a significant correlation between students’ burden level and parents’ attitude towards student burden reduction policies. We suggest building a collaborative “family-school-society” sustainable education system in China.

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Introduction

China's student burden reduction policy is a key response to UNESCO's Sustainable Development Goal for education (SDG 4), which aims to promote quality education (Abel et al., 2016; An et al., 2007; Baron et al., 2009). It aims to decrease inter-group educational inequity for improving the quality of classroom teaching in primary and secondary schools and expanding after-school services within schools (Battaglia, 2008; Bhardwaj, 2019). In essence, student burden reduction policies promote the transformation of unscientific educational evaluation measures, such as "only grades" and "only admissions" and provides policy support for the comprehensive implementation of programs aimed at balancing the cultivation of morality, intelligence, physique, beauty, and labor. These policies not only free children from the heavy homework burden and after-school training burden ("double reduction"), but also provide full support for each child's all-round development (Bhowmik, 2017; English and Carlsen, 2019). In addition, student burden reduction policies support the concept of lifelong education. Based on the core concept of promoting students' all-round development and healthy growth, they have transformed the promotion of educational concepts in families, schools, and society.

In addition, as social and cultural contextual background, the prevalence of educational desire in Chinese communities is considered an invisible impetus for self-improvement. Every Chinese parent has strong educational desire and expectation of "hope the son becomes a dragon" and "hope the daughter becomes a phoenix", which also belongs to a relatively common social phenomenon (Colglazier, 2015; Lewin, 2019). This kind of high educational desire expectation for children's education objectively leads to students' excessive academic burden, excessive psychological pressure, and long-term mental tension. The implicit educational desire increasingly intensifies students' and parents' anxiety and unease about learning and future development, which to some extent undermines the benign and sustainable development of education. The educational desire is considered the value judgment and expectation of education. They are influenced by many factors, both social and personal (Hizi, 2019; Kipnis, 2011). It varies with the educational values of individuals and their communities. From the historical perspective, there has been a profound cultural psychology in China since ancient times. The idea of educational desire is also considered as a cultural phenomenon that is imbedded in shaping China's educational system. Although there is objective scarcity of educational resources, the main factor causing parents' anxiety is subjective scarcity of resources, competition and ranking rather than the difference in the absolute quantity of educational resources lead to subjective scarcity. Parents are limited by their own life cannot get a better social transition, so they would like to put their hopes on the children. With such strong desires and expectations for their children, parents are often unable to accept the possibility that their children's future will not meet their expectations. The deep motivation behind parents' worry and expectation is that parents' expectation and investment in education show a double high trend (Chen, 2022; 2021). The demand for high-quality education makes parents willing to "over-invest" in their children. The influence of examination culture and high return on education is superimposed. Parents expect to help their children obtain better education opportunities and higher socio-economic status through education competition.

Building "family-school-society" sustainable education system is essential to address the phenomenon of student learning burden. Since the implementation of the "Double Reduction" policy, it has received increasingly high attentions and the "family-school-society" cooperative education involves the division of rights and responsibilities of multiple subjects. Most

existing policy documents are formulated and implemented from the perspective of the single subject of school, family, and society. They play different roles and functions in the process of students' learning and growth, which has a profound impact on the improvement of students' learning quality. The ecological mechanism of family-school-social cooperative education should be guaranteed, so that all parties can promote scientific cooperation while performing their respective functions and responsibilities, and truly take students as the center, to provide broader space, more diverse choices and more personalized support for family education and improve the practical sense of gain of students and families (Chen and Yu, 2022). Family education, school education and social education should be consciously and scientifically interleaved, superimposed and comprehensively applied. Building "family-school-society" sustainable education system aims to create both student-centered and quality-oriented educational ecological system in China.

Historically, China has committed to building a quality education system through various student burden reduction policies. Since the founding of the People's Republic of China in 1949, there have been three stages of student burden reduction policies: the teaching reform stage (1955–1999), the checklist-based burden reduction stage (2000–2020), and the root-based burden reduction stage (2021 to current). The teaching reform stage was limited to the burden reduction policy of improvement in internal teaching²⁰. Basic measures included not setting homework for minor subjects and reducing the number of tests. In the checklist-based burden reduction stage, point-to-point governance policies were issued around academic burden performance (Fan, 2020; Fu et al., 2019). Basic measures included the cancellation of the selection examination at the beginning of primary school, exemption from examination, evaluation of grade academic performance, and standardizing school running behavior. The root-based burden reduction stage involved the implementation of original root-based burden reduction actions centering on key areas such as improvement in teaching quality, after-school service provision, and balance in education quality (Liu et al., 2021). Basic measures included after-school service development, standardizing after-school training behavior, improving school, and teaching quality, and deepening the reform of the senior high-school enrollment process (Gao et al., 2022). In July 2021, the General Offices of the CPC Central Committee and The State Council issued *Opinions on Further Reducing the Homework Burden and Off-campus Training Burden of Students in Compulsory Education* (hereinafter referred to as the Opinions on the Double Reduction Policy), ushering in a new era of two-way governance in relation to burden reduction and marking a new stage in China's education reform (Luo and Zhang, 2022; Mei et al., 2021). The ideology underpinning the Opinions on the Double Reduction Policy is a "focus on the construction of a high-quality education system, strengthening the position of school education, deepening off-campus training organization governance, resolutely preventing the violation of public interests, providing good ecological education, effectively easing anxiety, and promoting students' all-round development and healthy growth (Liu and Zhang, 2022). The aim is to create a healthy living and learning environment for children in compulsory education and ensure that everyone enjoys similar quality education. Numerous previous studies have focused on the core underlying idea and practices related to the current education burden reduction policy, which aims to promote students' all-round development and healthy growth, with the core goals of "burden reduction" and "quality improvement" (Gu and Teng, 2019; Li et al., 2020). Promoting students' all-round development and healthy growth can only be achieved by reducing the burden

and improving quality, enabling classroom teaching to return to its original purpose of educating people through promoting the improvement of both teaching quality and teaching efficiency (Liu, 2022; Long, 2021).

However, no previous studies have simultaneously explored the macro-level dynamic changes and micro-level parents' views regarding the implementation of student burden reduction policies. Along with current literature review on the policies and other empirical research, we found that most studies concentrate on illustrating and explaining the policy goals, policy missions and policy actions of implementing student burden reduction policy in current China's education system at macro-level. However, there are few studies on empirical investigations on stakeholders' perspectives on implementing student burden reduction policy at individual level. Considering the features of current studies, we aim to mitigate the gap between macro and micro level to explore a more comprehensive landscape of analyzing student learning burden reduction policies. The main research questions of this study include: What are the overall development trends and policy implementation pattern of student burden reduction policies in China? What is the attitude of parents towards the policies of student burden reduction in China? What is the relation between students' burden level and parents' attitude towards student burden reduction policies? How can we build a sustainable education system for alleviating student learning burden? All these questions contribute to investigating the macro-level changes and micro-level parents' views regarding the implementation of student burden reduction policies, contextually. Thus, to address this gap, in this study, we simultaneously examined 232 documents related to student burden reduction policies from 1951 to 2021 and analyzed 23,567 parents' responses to questionnaire surveys across 29 provinces to identify both the dynamic changes that have occurred and parents' attitudes towards the implementation of student burden reduction policies.

Methods

To assess how student burden reduction policies contribute to promoting quality education, we undertook a two-step process. First, we analyzed the macro-level historical student burden reduction policies. Second, we leveraged the insights gained from this analysis to explore the micro-level parents' views on student burden reduction policies.

Historical student burden reduction policy analysis. We examined the number and subjects of student burden reduction policy texts, and changes over time. We identified 232 student burden reduction policies during the period 1951–2021, including 62 policies at the national level and 170 policies at the local level, totaling approximately 650,000 words, including the original policies, answers to reporters' questions and relevant attachments. In terms of subjects, we used word frequency analysis to identify the most frequently used keywords. Word frequency analysis involves statistical, screening of each word in specific text features such as frequency, the related degree, time changes. Word Frequency Analysis was first used to conduct word frequency statistics on relevant information in scientific and technological literature, such as title, author, keywords, institutions, classification numbers and references, etc., to observe the development of a discipline (field) by examining the changes in the Frequency of words. Then a method of analyzing the research topic, method, and direction in this field. We used Microsoft Excel and the Micro World cloud software package for our analysis. When the word frequency threshold was set to 1, that is, words appeared at least once in all policy texts, we identified 10,440 words. When

the threshold was increased to 59, we identified 232 words. We also analyzed the co-occurrence of words and constructed a relational network diagram in which the size of each node size represents the frequency of occurrence of the relevant word, with larger nodes representing higher frequencies.

Survey of parents' views on the implementation of student burden reduction policies.

We conducted an online survey of parents' views on student burden reduction policies in primary and secondary schools in 29 provinces in China in December 2021. We used convenience sampling, and the respondents were mainly concentrated in Guangxi, Inner Mongolia, Sichuan, Hebei, Jilin, and Yunnan. The data results truly reflect the understanding and concern of parents in China's underdeveloped areas, including Guangxi, Inner Mongolia, Sichuan, Hebei, Jilin, and Yunnan on the student burden reduction policies. And their attention to the student burden reduction policies in the central and western regions is parallel to their attention to educational equity. The samples mainly from Inner Mongolia and Sichuan also provide the sufficient discourse for the exploration of students' burden reduction politics in the less developed areas. Convenience sampling is a type of nonprobability sampling in which people are sampled with convenient sources of data for researchers. Convenience sampling differs from purposive sampling in that expert judgment is not used to select a representative sample of elements. A total of 23,567 questionnaires were distributed through WeChat, and 23,567 valid responses were received, of which 6516 (27.65%) were from male parents and 17,051 (72.35%) were from female parents. Of these, 5539 (85.0%) support, 689 (10.57%) did not support. A total of 288 people (4.42 percent) did not care. 13,783 (80.83%) supported by female. 2505 (14.69 percent) did not support it, and 763 (4.47 percent) did not care. A total of 15,601 responses (66.2%) were from agricultural households, while 7499 (31.82%) were from non-agricultural households and 467 (1.97%) were from other households. The choice "other households" was ready to test whether the interviewees have the basic personal regional recognition and identification about their families' regional classification (see Fig. 1). In fact, in China, officially, there isn't "other households" type and the item of other households indicate that people lack the basic regional recognition, and this data has been cleaned off in the later analyzed result.

Independent variable. The independent variable was parents' views on the implementation of the double reduction policy. Responses were measured on a five-point scale ranging from 0 to 1 where 0 = "support" and 1 = "do not support". We originally design the questionnaire with five-point scale and found that in the middle scale of the option with "not clear", and few parents choose this option for student assignments in the middle scale, including "don't know", "no ideas", and "not clear". Such middle scale options have greatly increased the analysis of the degree of difficulty and confusion without statistically scientific meanings. To enhance the degree of differentiation of scale options, the middle scale of the data is deleted and retained only four scale options, including "very supportive" and "support" "not support" "very does not support" in the re-constructed questionnaire format. To further streamline model and guarantee validity of the designed questionnaire, we merge 5-point scales into binary variables (Changing "very supportive" "support" "not support" "very does not support" into "support" and "not support") for the significance and distinction degree of data analysis.

Dependent variables. The dependent variables were duration of homework completion, duration of sleeping and burden level of

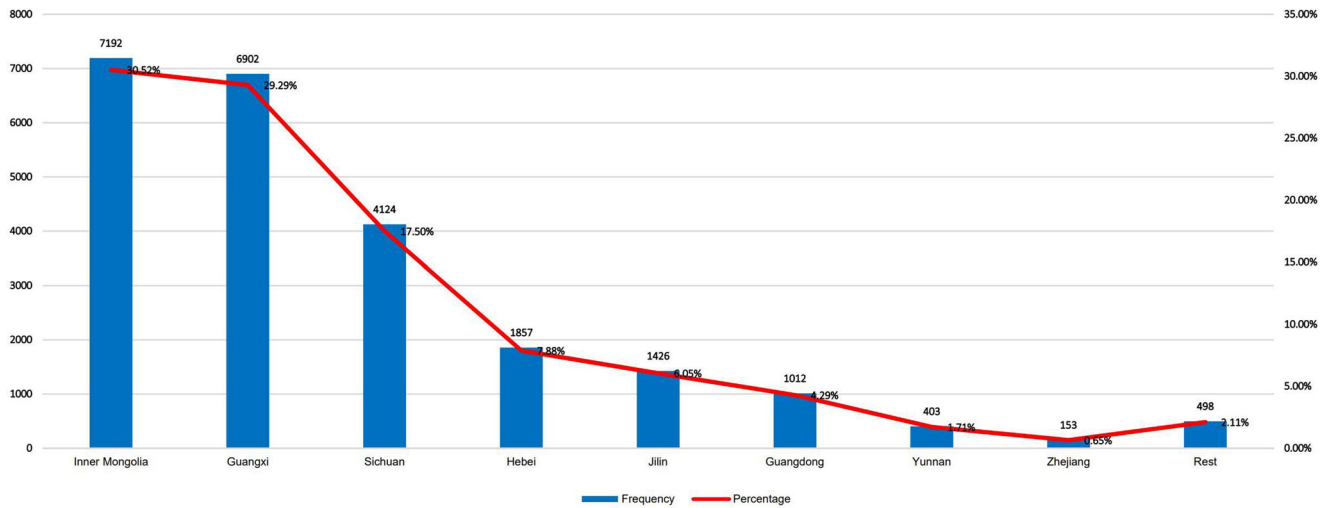


Fig. 1 The sample distribution of different regions in China. The blue bars represent the frequency of data acquisition in different regions. The red curve represents the proportion of data collected in the total data.

students before and after the double reduction policy based on the parents’ evaluation. In the survey of students’ homework duration, a five-point scale is applied in this questionnaire. It provides five options, including less than half an hour, 0.5–1 h, 1–1.5 h, 1.5–2 h, and more than 2 h. Responses regarding the burden level were measured on a five-point scale ranging from “very heavy” to “very light”. Duration of sleeping was measured using a six-point scale ranging from “six hours or less” to “10 h or more”. In the survey of students’ sleep time, the questionnaire adopts a six-point scale, which provides six options: less than 6 h, 6–7 h, 7–8 h, 8–9 h, 9–10 h, and more than 10 h. Duration of homework completion was measured using a five-point scale ranging from “less than 30 min” to “more than two hours”.

Control variables. The control variables were parents’ gender, location (urban or rural), education level and work unit. Our hypothesis was that parents’ attitudes towards the implementation of the double reduction policy should be either positively or negatively correlated with students’ academic burden, that is, the more satisfied parents are with the double reduction policy, the smaller or larger the students’ academic burden should be.

Partial correlation analysis. After controlling for parents’ gender, household location, educational background and occupation, parents’ views on the implementation of the double reduction policy were significantly correlated with their evaluation of the students’ burden, duration of homework completion and duration of sleeping. Therefore, H0, the null hypothesis, was supported ($p < 0.01$). Based on the independent and dependent variables that we selected, the following five-term regression equation with parents’ views on implementing double reduction and reducing students’ burden as independent variable x can be obtained:

$$y1 = 1.442 + 0.132x \tag{1}$$

where $y1$ represents the student burden evaluated by parents. In this model, $F = 308.822$ ($p < 0.01$) and $t = 17.573$ ($p < 0.01$), indicating that the independent variable x has a significant impact on y at the level of 99% confidence interval and there are significant differences at different levels.

$$y2 = 1.864 - 0.017x \tag{2}$$

In Eq. 2, $y2$ represents the daily homework duration of students in the last semester.

In this model, $F = 15.194$ ($p < 0.01$) and $t = -3.898$ ($p < 0.01$), indicating that the independent variable x has a significant impact on y at the level of 99% confidence interval and there are significant differences at different levels.

$$y3 = 1.84 - 0.001x \tag{3}$$

In Eq. 3, $y3$ represents the daily homework duration of students in this semester. In this model, $F = 4.696$ ($0.05 > p > 0.01$), $t = -2.167$ ($0.05 > p > 0.01$) indicating that the independent variable x has no significant impact on y at the level of 99% confidence interval and there are no significant differences at different levels.

$$y4 = 1.701 + 0.032x \tag{4}$$

In Eq. 4, $y4$ represents the number of hours students slept each day in the last semester. In this model, $F = 37.170$ ($p < 0.01$), $t = 6.097$ ($p < 0.01$), indicating that the independent variable x has a significant impact on y at the level of 99% confidence interval and there are significant differences at different levels.

$$y5 = 1.819 - 0.001x \tag{5}$$

In Eq. 5, $y5$ represents the number of hours students slept each day in the last semester. In this model, $F = 0.021$ ($p > 0.05$), $t = -0.146$ ($p > 0.05$) indicating that the independent variable x has no significant impact on y at the level of 99% confidence interval and there are no significant differences at different levels.

Harman single-factor test. The Harman single-factor test was used to determine whether there was obvious common method bias. There were 32 variables with an eigenvalue greater than 1. For the selected 10 items, the extracted variance of the first factor was 8.238%, which is 40% less than the common standard, confirming that there was no obvious common method bias.

Binary logistic regression. To identify the factors that significantly affected parents’ attitudes towards students’ burden reduction, we conducted a binary logistic regression analysis based on household type, gender, educational background, and occupation. As the responses were measured using a five-point scale, the median value “indifferent” was deleted, “very supportive” and “relatively supportive” were merged into “supportive”, and “not very supportive” and “unsupportive” were merged into “unsupportive”. A total of 16,457 supportive parents and 3194 unsupportive parents were selected using random sampling. More than 15% of the total

number of supportive parents were selected, and the sample size was more than five times that of the independent variable review. At the same time, the one-way variance met the standard, and thus binary logistic regression analysis could be undertaken.

Hosmer and Lemeshow test. The binary logistic regression model based on independent variables such as gender, household type, educational background and occupation was significant (Sig. = 0.163 > 0.05), indicating that the model had a good degree of fit.

In the model, parents' gender, household type and educational background had a significant impact on their attitude to the implementation of the double reduction policy ($p < 0.01$). Among them, female parents choose not to support negative attitude about 1.477 times of male parents. The situation of parents with non-agricultural household registration choosing not to support negative attitude is about 0.818 times that of parents with rural household registration. When parents' education level was increased by one level, the number of parents who choose not to support negative attitude increased by about 1.054 times. Thus, the following equation was obtained:

$$\text{logit}(p) = 0.111 + 1.477x_1 + 0.818x_2 + 1.054x_3 + 0.998x_4 \quad (6)$$

where $\text{logit}(p)$ is the parents' opinion on implementing the double reduction policy and reducing the students' burden (support = 0, non-support = 1), x_1 is the parents' gender (male = 0, female = 1), x_2 is the parents' household type (agricultural household = 0, non-agricultural household = 1), x_3 is the parents' educational background, and x_4 is the parents' occupation.

Robustness test: We tested endogeneity based on propensity value matching. The propensity score matching function in SPSS was used for nearest-neighbor matching, and the allowable matching error was 0.1. A total of 1726 pairs were successfully matched, 3199 times of accurate matching (i.e., PS was completely consistent), and 3084 times of PS fuzzy matching (caliper value was 0.1). Except for the postgraduate education group, all matching factors of different negative attitudes in the paired samples are equally comparable between the two groups. Binary logistic regression was carried out again based on the matched data. The Hosmer and Lemeshow test results showed that the binary logistic regression model using gender, household type, educational background and occupation as the independent variables was significant (Sig. = 0.196 > 0.05), indicating a good degree of fit.

$$\text{logit}(p) = 0.33 + 1.577x_1 + 1.199x_2 + 1.029x_3 + 1.002x_4 \quad (7)$$

In formula 7, $\text{logit}(p)$ represents the parents' opinion on implementing the double reduction policy and reducing the students' burden (support = 0, non-support = 1), x_1 is the parents' gender (male = 0, female = 1), x_2 is the parents' household type (agricultural household = 0, non-agricultural household = 1), x_3 is the parents' educational background, and x_4 is the parents' occupation. After the tendency to value matching model is significant, but the variables in the equation of the significant changes, compared with the result of Eq. 6, constant apparent decline, show that model explanatory power to ascend, parents' coefficient significantly and variation among gender, registered permanent residence is not big, show that gender, parents account types are still significantly affecting the dependent variable. In general, the coefficient of each variable did not change significantly after matching, and thus the model was robust.

Results

Macro-level dynamic changes in student burden reduction policies. China's student burden reduction policies have shown an overall trend of growth. From 1951 to 1970, eight relevant policies were issued. *The Decision on Improving the Health Condition of Students in Schools at All Levels*, released by The State Council on 6 August 1951, was the first policy on student burden reduction in China. Over the following 40 years, the number of student burden reduction policies increased sharply, before starting to decline. From 1991 to 2000, there were 12 national student burden reduction policies totaling more than 33,000 words, while there were no more than five policies at any given time from 1971 to 2010. Since 2011, there has once again been rapid growth in the number of national student burden reduction policies, with 16 policies issued between 2011 and 2020, and 19 policies issued in 2021 totaling approximately 62,000 words (see Fig. 2).

In addition, from June to December in 2021, the number of local policy documents was significantly higher than that of central policy documents (Yang, 2019; Yang and Wang, 2022). The double reduction policy introduced in 2021 represents a new stage in China's student burden reduction policies from the previous approach of one-way governance to a new approach involving both on-campus and off-campus governance. The total number of student burden reduction policies in China has remained between 30 and 40, while the number of student burden reduction policies released by the central government has decreased.

Student burden reduction policies follow the form "Central leadership + Ministry of Education sovereignty + multi-department coordination". We analyzed the changes in issuing agencies in relation to student burden reduction policies issued by the state from the central leadership to the Ministry of Education, and then to joint issuance by multiple departments, including Ministry of Finance, Ministry of Human Resources and Social Security, State Administration for Market Regulation, and Ministry of Public Security. During the period from 1981 to 1990, the policy released by the central committee of the communist party of China and the State Council (special authorization) accounted for 100% and the number of documents for multiple national ministries jointly issued released by the Ministry of Education fell to 50% (see Fig. 2).

Parents have received relatively little attention in terms of student burden reduction policies. Students' after-school life, homework arrangements and subject teaching are the core concerns of the burden reduction policy. Word frequency analysis revealed that "students" was a core word in all burden reduction policy documents, appearing 3712 times in total, while "training" and "school" were also keywords, appearing 5845 times and 3041 times, respectively, while "institutions" and "off-campus" appeared 3633 times and 3066 times, respectively. In terms of words taught to each student, 1452 words were taught by teachers and 856 were taught by parents. In terms of the drawback of word frequency method, we can extract and connect their core meaning as "off-campus training for school students", "principal training", "teacher training", and "student training" based expert and literature judgment. Analyzing all kinds of teaching activities, the word "education" appeared 2723 times, while the words "after-school", "homework" and "subject" appeared 2106 times, 1924 times, and 1819 times, respectively, indicating that after-school life, homework arrangements and subject teaching comprise the "main battlefield" in relation to the burden reduction policy. In addition to teaching activities, the burden reduction policy also involves education management and services, and thus the words "services", "management", and "charge" appeared 2712 times, 1359 times, and 979 times,

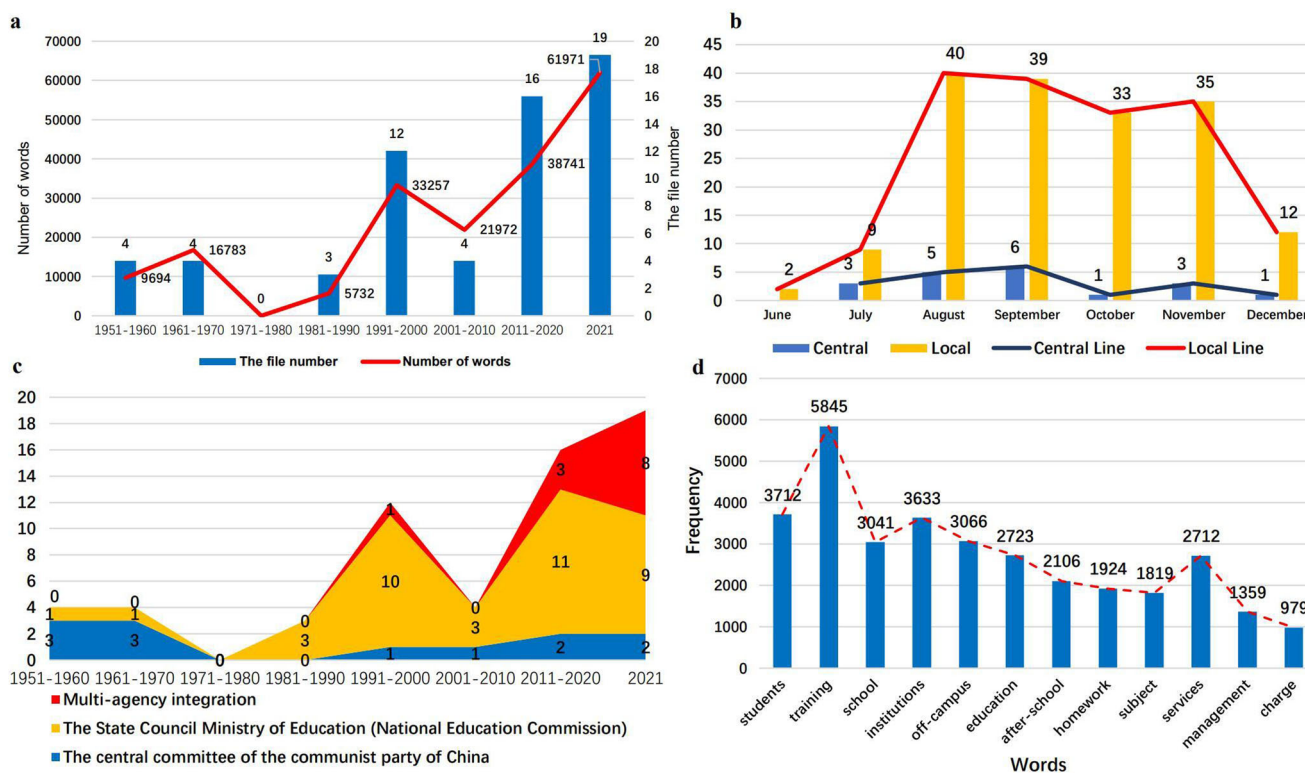


Fig. 2 Overall analysis of student burden reduction policies. **a** Number and word count of national student burden reduction policies from 1951 to 2021, **b** changes in the number of central and local student burden reduction policies in 2021, and **c** changes in the agencies issuing student burden reduction policies from 1951 to 2021 **d** word frequency of student burden reduction policies from 1951 to 2021.

respectively. In contextual background of student burden reduction policies, the word “services” means providing off-campus learning services, including off-campus tutorial class, after-school learning, and family education. The word “management” means off-campus agencies’ management, such as financial affairs, personnel recruitment, and operating affairs. The word “charge” means off-campus tuition fee, including students’ training expense and tutorship fee (see Fig. 3).

The participation of teachers, parents and society in the burden reduction policy is obviously insufficient, and there is a big gap between them and the students. “Students” and “institutions” are the most common words in China’s student burden reduction policy, ranking first and second in terms of frequency with 3712 and 3633 appearances, respectively. The word “school” ranked third with a total of 3041 appearances, significantly less than the top two words. Among the main policy participants, teachers, parents, and society ranked fourth to sixth, with 1452, 856, and 683 appearances, respectively, significantly less than the top three words. In general, China’s student burden reduction policy is aimed at students. However, although they are important participants in educational activities, teachers, parents, and society are obviously not sufficiently involved in the burden reduction policy, lagging far behind the top three terms in terms of frequency of appearance in policy documentation. Our analysis of the changes over time in the frequency of appearance of keywords in the burden reduction policy showed that students have always maintained a high ranking, while parents have remained at the bottom of the rankings. Looking at various periods, the relative frequency of the word “students” has always been high but has declined significantly in recent years. During the period 1951–1960, “students” accounted for more than 60% of the keywords. This gradually declined during the period 1961–2000, reaching 20% during the period 2011–2021. While

the frequency of appearance of the word “students” has fallen, the frequency of the word “institution” has increased significantly since 2011. Before 2011, “institution” accounted for less than 10% of all keywords. During the period 1981–2010, there were only 66 instances of “institution”, but this increased to 127 during the period 2011–2020 and then soared to 3440 in 2021, accounting for about 30% of the total number of keywords. This was significantly higher than the 202 times the word “students” appeared. There was no significant change in the proportions of the appearance of “schools” and “teachers” over the full period. The word “schools” accounted for 25–30% during the period 1951–2020 before falling to less than 25% in 2021. The word “teachers” was stable throughout the entire period at about 10%, while the word “society” showed an upward trend, from 0% during the period 1951–1960 to more than 10% during the period 2011–2020, before falling to less than 5% in 2021. The word “parents” has long been the least frequently used key word in student burden reduction policies. During the period 1951–2010, the word “parents” accounted for less than 4% of keywords. There was a slight increase during the period 2011–2020, followed by a decline in 2021. This shows that although parents have long been one of the most important participants in education, they have not received much attention in student burden reduction policies (see Fig. 3).

The participants (students, institutions, schools, teachers, parents, and society) in the student burden reduction policy all interact with and influence each other. Our analysis of the co-occurrence of words showed the burden politics in students, institutions, schools, teachers, parents, society, six education participants’ top 10 co-occurrence words and its frequency, no matter what kind of education, participants in the policy burden of co-occurrence with related vocabulary for arrange pick some differences, but in general can be divided into three categories.

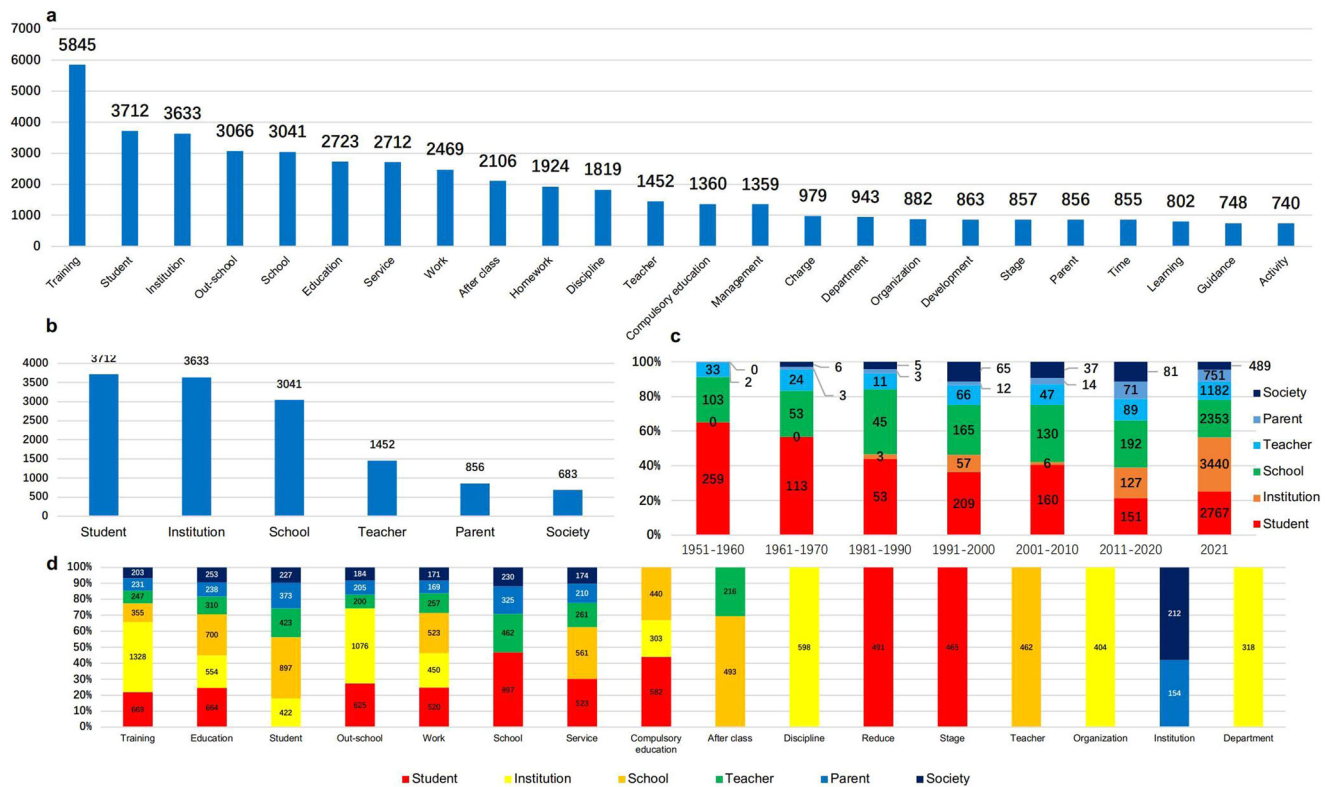


Fig. 3 Results of word frequency analysis of 232 student burden reduction policies. **a** Highest frequency words, **b** frequency of words representing the various participants in student burden reduction policies, **c** frequency variations over time from 1951 to 2021, and **d** co-occurrence analysis.

The first category includes schools, training, students, and education, the second category includes off-campus, work, and services, and the third category includes development, strengthening and after-school. The positions of these three echelons are basically the same in the ranking of co-occurrence words of participants of different burden reduction policies, indicating that there is no significant difference in the top 10 co-occurrence words related to different participants. However, teachers, parents and society have relatively single status and tasks in the burden reduction policy, and the high-frequency co-occurrence words mainly involve education and teaching and other educational participants.

Micro-level parents’ views regarding the implementation of student burden reduction policies. There is a significant correlation between students’ burden level and parents’ attitudes towards the double reduction policy. Our correlation analysis showed that parents’ evaluation of students’ burden level, duration of homework completion during the previous semester, and duration of sleeping during the previous semester and their opinions regarding the implementation of the double reduction policy were significantly correlated at $p < 0.01$, with correlation coefficients of 0.112, -0.022 , and 0.039, respectively. This suggests that burden lighter parents believe that her children tend to choose not to support the implementation of the policy and burden of students, the same goes in sleep longer in the students’ parents, and longer job completion students, their parents, the more inclined to choose to agree, support “double reduction” policy implementation, and burden to students. The result shows that 84% parents support implementing student learning reduction policies and 16% not support (see Fig. 4).

Parents’ gender is an important factor influencing their views on the student burden reduction policy, with female parents less likely than male parents to support the double reduction policy.

The number of female parents who chose not to support the policy was 1.557 times higher than that of male parents. Binary logistic regression after propensity value matching showed that the parent gender variable was significant at $p < 0.01$, with the confidence interval ranging from 1.388 to 1.746. This might be because female parents generally have higher expectations in relation to their children’s education than male parents.

Household type is also an important factor influencing parent’s views on the student burden reduction policy. Parents in urban households (“Hukou”) were less inclined to support the double reduction policy than those in rural households. Binary logistic regression after propensity value matching showed that the variable representing parental household type was 1.199 and significant at $p < 0.01$, with the confidence interval ranging from 1.073 to 1.340. This might be because parents in urban areas generally have higher expectations in relation to their children’s education than parents in rural areas.

Discussion

Unpacking both the macro-level dynamic changes and micro-level stakeholders’ (parents) views regarding the implementation of student burden reduction policies is crucial for exploring and implementing practical, holistic policies in China’s various educational contexts. Our study provides an innovative perspective regarding student burden reduction policies and examines the potential problems of integrating the macro- and micro-level approaches.

Both the ideo-political and socio-economic reasons contribute to the dynamic changes in several successive stages during the period of 1951 to 2021. For socio-economic reason with the improvement of economic and cultural level in domestic cities, more and more people pay attention to the problem of reducing students’ burden, advocate students’ diversified development, and gradually pay attention to the balance between students’ physical

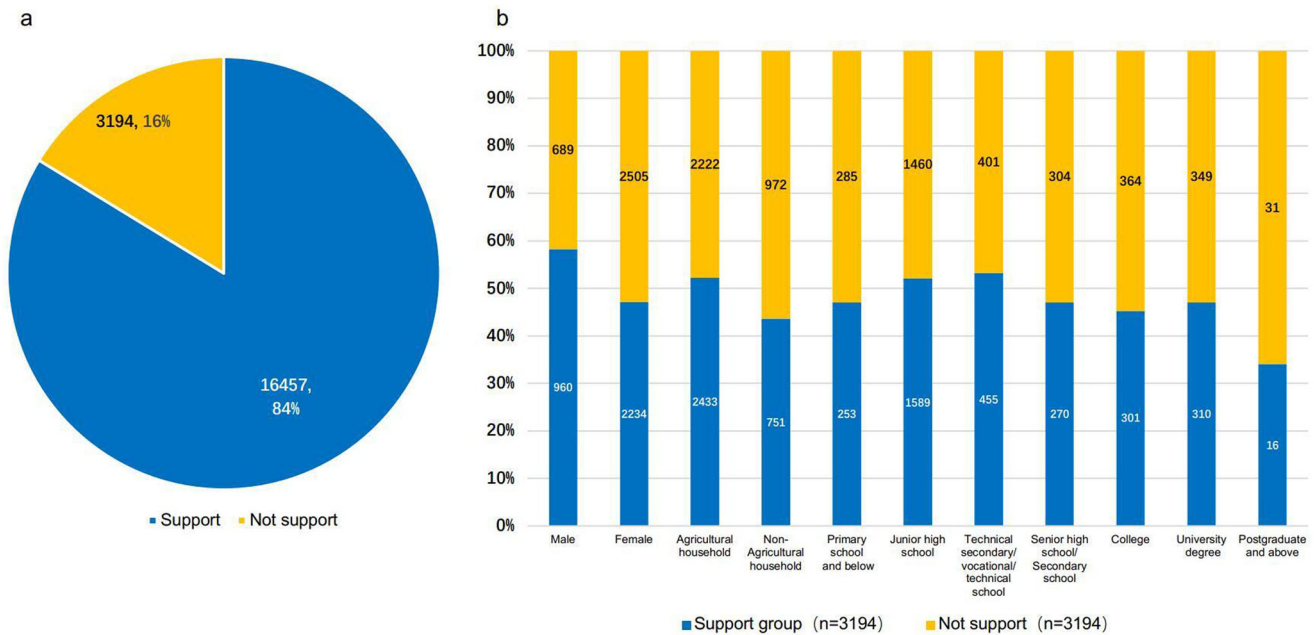


Fig. 4 Parents' views on student burden reduction policies. **a** Parents' views on student burden reduction, and **b** baseline comparison (after matching).

and mental growth (Yu, 2021; Yuan, 2021; Yuan et al., 2021). Along with this strategy, China's central government released student burden reduction policies aimed at modernizing the development of a quality education system. In addition, the form "Central leadership + Ministry of Education sovereignty + multi-department coordination" highlights the new governance approach to education policy implementation (Zhang et al., 2022).

Based on the results, it is found that there existed multi-level tension forces and their inter-relationships have significantly impacted on the implementation of student learning reduction policies (Ngok 2007; Ning, 2020; Pan et al., 2022). The student learning burden reduction policy is one of the most influential policies in the field of education. The main reasons for the formation of students' burden are the low quality of school teaching, the difficulty of textbooks and the limited teaching ability of teachers. To reduce the burden of students, on the one hand, it is required to ensure the students' sleep and rest time; On the other hand, it emphasizes the improvement of teaching materials and the training of teachers to improve their teaching ability. The goal of shaping the new pattern of educational development is to respond to the demands of multiple interests in the field of education. It turns out that our interests in the field of education are relatively simple. Every family wants their children to receive a high-quality education. Now we need to take students' healthy growth into consideration in a comprehensive way, which should conform to the nature of human development, the nature of education development and the nature of national development, to respond to the new demands of the diversified student growth pattern.

We found that parents received relatively little attention in relation to student burden reduction policies, and that the participation of teachers, parents and society in student burden reduction policies is obviously insufficient. It is necessary to balance the development of school education and out-of-school education to build a sustainable education system in China. The most important task is to clarify the support role of parents in relation to the student burden reduction policy to enable China to achieve the core goal of a collaborative "family-school-society" education system (Zhang and Bray, 2015; Zhao et al., 2022).

The student burden level is significantly correlated with parents' attitudes towards the student burden reduction policy. In terms of gender and social status, female parents from urban households ("Hukou") are less likely to support the policy than male parents from rural households. Parents' gender is an important factor influencing parents' concept of student burden reduction. The reason may be that female parents generally have higher expectations on children's education than male parents. In addition, the household registration type of the parents is also an important factor affecting the concept of student burden reduction. According to binary logistic regression after propensity value matching, the variables of household type of parents in the model are significant at the level of $p < 0.01$, and the confidence interval is between 1.073 and 1.340. The household registration coefficient of parents is 1.199, indicating that the non-agricultural household registration parents from urban areas (non-agricultural = 1) are 1.199 times more likely than the agricultural household registration parents to choose not to support "implementing double reduction and reducing the burden of students". The reason may be that the non-agricultural household registration parents generally have higher educational expectations for students than the agricultural household registration parents. Above results suggest that the gap between urban and rural education increases the gap between urban and rural parents' attitudes towards the student burden reduction policy (Tang and Dang, 2022). It is difficult to form the ecology of home-school cooperative education. As the main body of family education and community education is often absent, the education of left-behind children in schools often falls into an unmanageable dilemma.

We also found that the student burden reduction policy not only involves the reform of school education and out-of-school education, but also is aimed at promoting the development of a sustainable education system, which requires the reconstruction of multiple relationships among the government, schools, society, and families. It is difficult to achieve this by relying solely on the education system under the leadership of the government, and thus it requires the coordination of parents, schools, and society. The development of a sustainable education system is the core goal of the student burden reduction policy, and the concept of equitable, inclusive, high-quality, lifelong sustainable

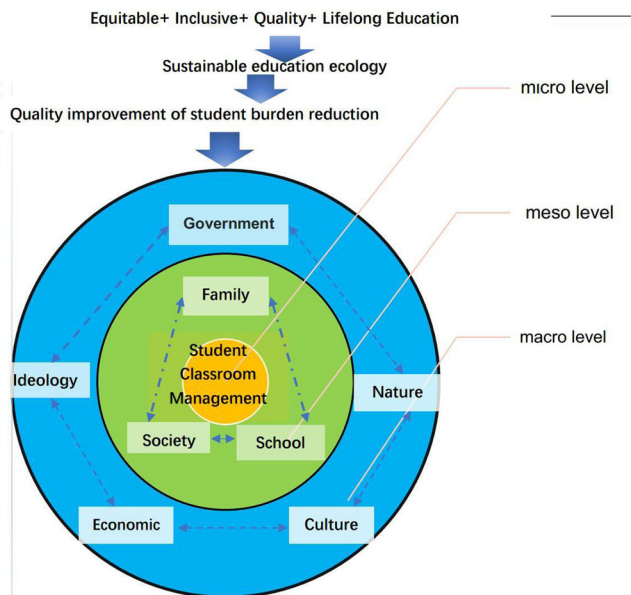


Fig. 5 The relationship between a collaborative “family-school-society” education system and student burden reduction policies. The yellow inner circle represents the micro level of student learning and management on campus; The green middle layer represents the interactive dynamic relationship among family, school and society at the meso-level. The blue outermost layer represents the interaction among government, economy, culture, society, ideology and natural sustainable development at the macro level.

development is the basis of the entire education system (Zhou and Qi, 2021). Equitable and inclusive education is the horizontal dimension of sustainable development, while high-quality, lifelong education is the vertical dimension. A sustainable education system consists of three levels. The first level is the macro system, which includes government support, ideology, the natural environment, the economic environment, and the cultural environment, which together constitute the external environment. The second level is the meso system, which includes family education, school education, social education, and after-school education. The third level is the micro system, which includes teacher ecology, student ecology, classroom ecology, and management ecology, all of which constitute the school education ecology (see Fig. 5).

There are some limitations of this study. For example, without collecting the teacher survey data under the double reduction policy, it is not easy to infer a good balance among three types of stakeholders, students, parents, and teachers under the double reduction policy. For future studies regarding student learning burden reduction policies, more closely connections between various data patterns and the emergence of the home-school-community model are needed to be considered.

The results of our study deepen our understanding of both the macro-level dynamic changes and the micro-level stakeholders’ (parents) attitudes regarding the implementation of student burden reduction policies. They also contribute to the development of a collaborative “family-school-society” educational system in China in pursuit of SDG 4. As more data become available in the future, such as data from other countries’ student burden reduction policies, our approach will be readily applicable to updated quality education development goals to provide a comprehensive comparison among various countries and regions. More stakeholders, including students, teachers, and policymakers, should be included in future studies to obtain a

more comprehensive range of attitudes towards the implementation of student burden reduction policies (Xue, and Li, 2022; Xue et al., 2021). In terms of methodology, the causal relationships between various factors influencing stakeholders’ views should be investigated in future studies. Additional data and advanced methods of analysis will enable us to move from correlation to causality (Wang et al., 2022).

In conclusion, in this study, we investigated the macro-level dynamic changes and micro-level parents’ views regarding the implementation of student burden reduction policies aimed at developing a collaborative “family-school-society” education system in China in pursuit of SDG 4. The results of this study strengthen our understanding of the development of a sustainable education system in the Chinese context and highlight the necessity of further studies integrating dynamic changes and micro-level parents’ views regarding the implementation of student burden reduction policies in different contexts.

Data availability

The paper by Li et al. (2020) (full paper) includes a dataset that has been deposited in the journal’s Dataverse repository. <https://doi.org/10.7910/DVN/SHUTWU>

Received: 16 June 2022; Accepted: 12 April 2023; Published online: 28 April 2023

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Acknowledgements

This study is supported by National Social Science Foundation Youth Project in Education “Study on Process Tracking and Effect Evaluation of Policy Implementation of Excellent Teacher Plan in Ministry-affiliated Normal Universities” (Project No.: CIA220282).

Author contributions

Conceptualization, JL and EX; Data curation, JL and EX; Formal analysis, EX and JL; Funding acquisition, EX; Investigation, EX, JL and CL; Methodology, JL and EX; Software, CL and JL; Supervision, EX and JL; Validation, EX and JL; Visualization, CL, JL and XL; Writing—original draft, EX and JL; Writing—review & editing, JL, EX, CL and XL. EX and JL contribute equally to this study.

Competing interests

The authors declare no competing interests.

Ethical approval

This research received the ethical approval from Ethical Review Committee, Faculty of Education, Beijing Normal University. We confirm that all research was performed in accordance with relevant guidelines/regulations applicable when human participants are involved by Declaration of Helsinki.

Informed consent

We confirm that informed consent was obtained from all participants and/or their legal guardians for participation in the study.

Additional information

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