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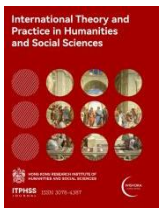

Study on the needs and implementation strategies of menstrual education in the upper grades of primary schools: A survey analysis based on 800 respondents

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Abstract

Menstrual education is an important part of adolescent health education, but it is generally lagging behind in primary schools in my country. This study adopted a cross-sectional survey design and conducted a questionnaire survey on 800 respondents (primary school students in grades 5-6, junior high school students in grades 1 and parents) from 15 schools in a certain city to evaluate the current situation and needs of menstrual education in the upper grades of primary schools. A self-compiled questionnaire was used to cover five dimensions, including knowledge understanding, educational needs, and troubled experiences. The questionnaire had good reliability (Cronbach's α=0.847). The results showed that only 26.8% of the respondents had a good grasp of menstrual knowledge, 48.0% believed that the current school education was insufficient, 75.4% supported the establishment of a special menstrual education course in the upper grades of primary schools, 72.9% suggested that it should be implemented in grades 5-6 of primary schools, and 63.6% had been troubled by insufficient knowledge. The study showed that the current popularization rate of menstrual knowledge in the upper grades of primary schools is low, there are significant deficiencies in school education, and there is an urgent need to open a special course. It is recommended to systematically carry out menstrual education in grades 5-6 of primary school, establish a multi-dimensional curriculum system, adopt diversified teaching methods, strengthen teacher training, and create an open and inclusive educational atmosphere.

1. Introduction

Menstruation is a normal physiological phenomenon for women. However, due to the lack of traditional cultural concepts and education, the topic of menstruation has long been regarded as a taboo in my country, and related education is seriously lagging behind. The World Health Organization pointed out that adequate menstrual education is of great significance to promoting the physical and mental health development of adolescents. In recent years, with the change of social concepts, menstrual education has gradually received attention, but there are still many problems in terms of educational content, timing and methods (Chen et al., 2025).

At present, there are mainly the following problems in menstrual education in my country: First, the timing of education is lagging behind. In the current education system, menstruation-related content is mainly involved in junior high school biology classes, and the age of girls' menarche is generally advanced, resulting in many students failing to obtain sufficient knowledge preparation before physiological development. Secondly, the educational content is single. Existing education is mostly limited to the introduction of physiological mechanisms, lacking practical content such as psychological counseling and health care. Thirdly, the educational method is traditional. The single mode dominated by teacher lectures is difficult to meet the diverse needs of students and lacks interactivity and practicality (Guo et al., 2024).

The upper grades of primary school (grades 5-6) are a critical period for children to transition to adolescence (He et al., 2025), and are also an important window period for menstrual education. Students at this stage are in the budding period of puberty (Huang et al., 2024), and some female students may have or are about to experience menarche (Ji et al., 2025), and they are in urgent need of scientific menstrual knowledge and psychological support (Li, 2024). However, there is a relative lack of research on the menstrual education needs of this group, and there is a lack of systematic empirical survey data (Li, 2025).

Therefore, this study systematically investigated the needs of upper grade primary school students and parents for menstrual education through a large sample questionnaire survey (Li et al., 2024), analyzed the shortcomings of current education, and proposed improvement strategies to provide empirical evidence for building a scientific and effective menstrual education system (Li et al., 2025).

2. Research Methods

This study adopts a cross-sectional survey design and collects data through structured questionnaires, aiming to fully understand the needs and attitudes of senior primary school students and parents towards menstrual education. Cross-sectional surveys can obtain information on the current situation of the target population at a specific time point, which is suitable for exploratory research and demand assessment (Li et al., 2024).

2.1 Research subjects and sampling methods

A stratified random sampling method is used to ensure the representativeness of the sample and the extrapolation of the research results. First, the target schools are divided into two levels: primary school and junior high school according to the type of school. At the primary school level, 10 primary schools of different types in a certain city were randomly selected, including 4 public key primary schools, 4 public ordinary primary schools and 2 private primary schools, to ensure the diversity of the sample. At the junior high school level, 5 junior high schools were randomly selected, including 3 public junior high schools and 2 private junior high schools. The selection of schools takes into account factors such as geographical distribution, nature of school operation, and school level, so as to reflect the overall situation of senior primary school students and parents in the city to the greatest extent (Li et al., 2025).

Within each school, classes were randomly selected using a random number table method, and then all eligible students and parents were invited to participate in the survey (Liu & Zhao, 2025). Specifically, 2-3 fifth-grade classes and 2-3 sixth-grade classes were randomly selected from each primary school (Luo et al., 2025), and 2-3 first-grade classes were randomly selected from each junior high school (Luo et al., 2024a). The final sample target

was 800-1000 respondents, and 800 valid questionnaires were actually collected (Luo et al., 2024b).

The inclusion criteria strictly defined the research subjects: (1) Primary school students in grades 5-6, usually between 10-12 years old, who are in the budding stage of puberty; (2) Junior high school students in the first grade, usually between 12-13 years old, who may have experienced or are about to experience puberty; (3) Parents or guardians of the above students, as important educational participants and decision makers; (4) Voluntary participation in the survey to ensure the ethics and reliability of data collection (Ma et al., 2024).

The exclusion criteria clearly defined subjects who were not suitable for participating in the study: (1) those with severe cognitive impairment, including intellectual disability, severe learning disabilities, etc., which may affect the accuracy of questionnaire comprehension and answers; (2) those who filled out incomplete questionnaires (Ma et al., 2025). Questionnaires with more than 20% missing data will be excluded to ensure the validity of data analysis; (3) those who filled out the questionnaires repeatedly (Ma et al., 2024). Duplicate questionnaires were identified and excluded through IP addresses and personal information; and (4) those who answered questions perfunctorily (Mao et al., 2025), such as choosing the same option for all questions or answering in an obviously illogical pattern (Peng et al., 2025a).

2.2 Survey tool development and validation

The self-compiled "Questionnaire on Menstrual Education Needs for Senior Grades of Primary Schools" was used, and the questionnaire development went through a rigorous scientific procedure. First, through literature review and theoretical analysis, the research team constructed a conceptual framework for menstrual education needs and determined the core dimensions and key indicators of the survey (Peng et al., 2025b). Secondly, 5 experts in related fields (including 2 health education experts, 2 child psychology experts, and 1 obstetrician and gynecologist) were invited to evaluate the content validity of the questionnaire. The expert consistency coefficient reached 0.89, indicating that the content validity of the questionnaire was good (Rong et al., 2025).

The questionnaire was revised after two rounds of expert discussion and one pre-survey (Wang et al., 2024). The first round of expert discussion mainly focused on the structural framework, question setting and expression of the questionnaire (Wang et al., 2025). According to the expert opinions, the expression of some questions was adjusted, and instructions for handling sensitive issues were added (Wang et al., 2024). The second round of expert discussion focused on the scientificity and feasibility of the questionnaire, and confirmed the final question setting and survey process (Xu et al., 2025).

The pre-survey was conducted in August 2024, and 100 students and parents of different grades were selected for trial testing. The results of the pre-survey showed that the questionnaire filling time was about 8-12 minutes, which was in line with the attention characteristics of the target population. Through item analysis, two questions with low discrimination were deleted, and finally a formal questionnaire with 19 questions was determined. The results of the preliminary survey showed that the overall internal consistency reliability of the questionnaire was Cronbach's $\alpha=0.847$, and the reliability coefficients of each dimension were between 0.72-0.88, indicating that the questionnaire had good reliability (Xu et al., 2025).

The questionnaire contains 19 questions, covering 5 dimensions. The basic information dimension (3 questions) includes the identity of the respondents, gender, and the time when they first learned about menstruation knowledge, providing a basis for grouping for subsequent analysis. The dimension of menstrual knowledge understanding (4 questions)

assesses the respondents' mastery of menstrual knowledge, the way to obtain it, and their evaluation of existing education. The dimension of educational demand attitude (5 questions) explores the respondents' attitudes towards the establishment of special menstrual education courses, the preferred grade, the expected educational content and form, etc. The dimension of related experience distress (3 questions) understands the respondents' distress experiences caused by insufficient menstrual knowledge, the choice of help objects, and the attitudes towards the surrounding environment. The dimension of improvement suggestions (4 questions) collects the respondents' specific suggestions for improving school menstrual education, including aspects that need improvement, course frequency, teacher selection, and support measures (Yu et al., 2025).

The questionnaire adopts a combination of single-choice, multiple-choice and open-ended questions (Zhang et al., 2024). Single-choice questions are mainly used to measure single-dimensional variables such as attitudes and frequencies, multiple-choice questions are used to understand diversified needs and preferences, and open-ended questions provide respondents with space for free expression. The language of the questionnaire fully considers the understanding ability of the target population, avoids the use of overly professional or sensitive words, and ensures that respondents of different ages can accurately understand the meaning of the questions (Zhang et al., 2023).

2.3 Data Collection Procedure

The survey was conducted from September to November 2024, lasting for 3 months, using an online questionnaire to improve survey efficiency and data quality. The research team fully communicated and coordinated with each school in advance and obtained the support of school leaders and relevant departments. Before the formal survey, the research team provided the school with a detailed survey description, including the purpose of the study, the content of the survey, ethical considerations, etc., and trained the class teachers participating in the survey (Zheng et al., 2025).

Data collection adopted a multi-channel approach to ensure the representativeness of the sample. The questionnaire link was mainly distributed to students and parents through the class teacher, and the survey information was released on the school's official website, parent WeChat group and other platforms. In order to increase the recovery rate, the research team set up appropriate incentives, including providing small gifts to respondents who completed the questionnaire and providing relevant health education materials to actively cooperating schools.

All participants were informed of the purpose, content, use and data confidentiality principles of the survey before filling out the questionnaire, and obtained informed consent. The research strictly adheres to ethical principles to ensure the privacy and autonomy of the respondents. For underage students, in addition to obtaining their own consent, the consent of their parents or guardians is also required. The questionnaire is anonymous and does not collect any personally identifiable information.

To ensure data quality, the research team established a multi-level quality control mechanism. On the technical level, functions such as mandatory item check and logical consistency check are set to prevent the generation of invalid questionnaires. On the content level, perfunctory answers are identified by setting test questions and repeated questions. On the time level, a reasonable filling time range is set, and too short or too long filling time will be marked as a suspicious questionnaire (Zhou et al., 2025).

2.4 Statistical analysis method

SPSS 26.0 statistical software is used for data analysis, and a variety of statistical methods are used to comprehensively analyze data characteristics and variable relationships. Data analysis is divided into three levels: descriptive analysis, comparative analysis, and correlation analysis.

Descriptive statistical analysis is used to comprehensively describe the distribution characteristics of each variable. For categorical variables, frequency, percentage, composition ratio and other indicators are used to describe their distribution status, and data characteristics are intuitively displayed through charts. For rank variables, in addition to frequency distribution, location parameters such as median and quartile are also calculated. Descriptive analysis is not only for the whole sample, but also for different groups (such as students vs. parents, different grades, etc.) to reveal the differences between groups.

Comparative analysis mainly uses the chi-square test (χ^2 test) to compare the differences between different groups. Specifically, it includes: (1) comparing the differences in menstrual knowledge and educational needs among respondents of different identities (students vs. parents); (2) comparing the differences in related variables among students of different grades; (3) comparing the attitude differences among respondents of different genders, etc. For ordered categorical variables, the Mann-Whitney U test or Kruskal-Wallis test is also used for comparison. When the number of cells with expected frequencies less than 5 exceeds 20%, the Fisher exact probability test is used.

Correlation analysis mainly uses Spearman rank correlation analysis to explore the correlation between variables. Key analysis: (1) The relationship between the degree of menstrual knowledge and the experience of distress; (2) The relationship between the evaluation of existing education and the need to open new courses; (3) The relationship between age/grade and various attitude variables, etc. For multiple-choice questions, they are converted into multiple binary variables for correlation analysis.

All statistical tests were two-sided, and the significance level was set at $\alpha = 0.05$. For multiple comparisons, the Bonferroni method was used to adjust the α level to control type I errors. The effect size was calculated using Cramer's V coefficient (for chi-square test) and the correlation coefficient itself (for correlation analysis) to assess the practical significance of statistical significance.

Data analysis also included data cleaning steps such as missing value processing and outlier detection. Missing value analysis used Little's MCAR test to assess the missing mechanism, and multiple interpolation was used for randomly missing data. Outlier detection used box plot method and standardized residual method, combined with professional judgment to decide whether to delete or adjust outliers.

To ensure the reliability of the analysis results, all major analyses were subjected to sensitivity analysis, including changing the grouping method, excluding extreme values, and using different statistical methods to assess the robustness of the results. At the same time, two statistical experts from the research team independently conducted key analyses to ensure the accuracy of the analysis process and results.

3. Results

3.1 Basic characteristics of respondents

A total of 800 valid questionnaires were collected, with a response rate of 96.4%. Among the respondents, 195 fifth-grade primary school students (24.4%), 278 sixth-grade primary school students (34.8%), 208 first-grade junior high school students (26.0%), and 119 parents

(14.9%). Gender distribution: 476 females (59.5%), 324 males (40.5%). The identity distribution of the respondents is shown in Figure 1.

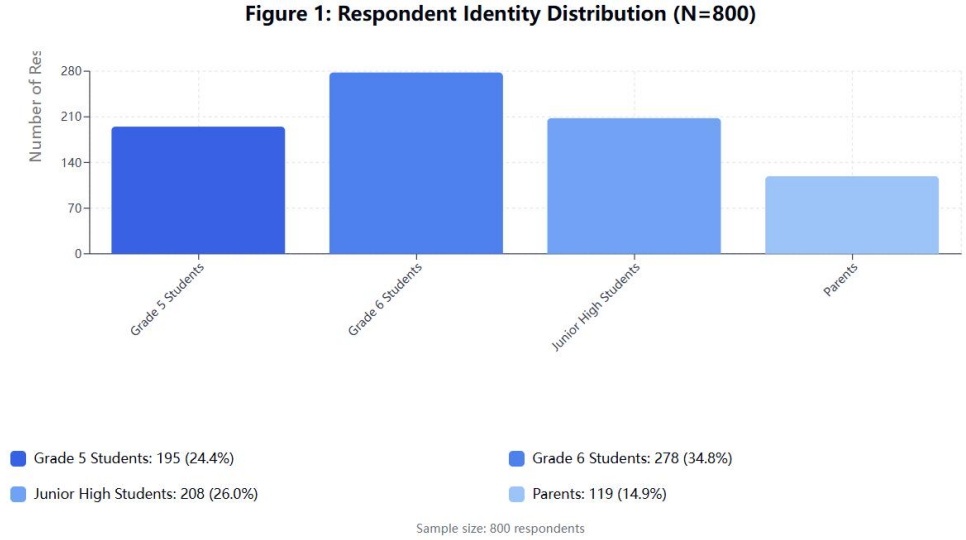

Figure 1: Respondent Identity Distribution

3.2 Knowledge of menstruation

Only 70 people (8.8%) said they knew it very well, 150 people (18.8%) knew it relatively well, 336 people (42.0%) knew it generally, 156 people (19.5%) knew it not very well, and 88 people (11.0%) knew it completely. Overall, only 26.8% of the respondents had a good grasp of menstruation knowledge. The distribution of the degree of knowledge of menstruation is shown in Figure 2.

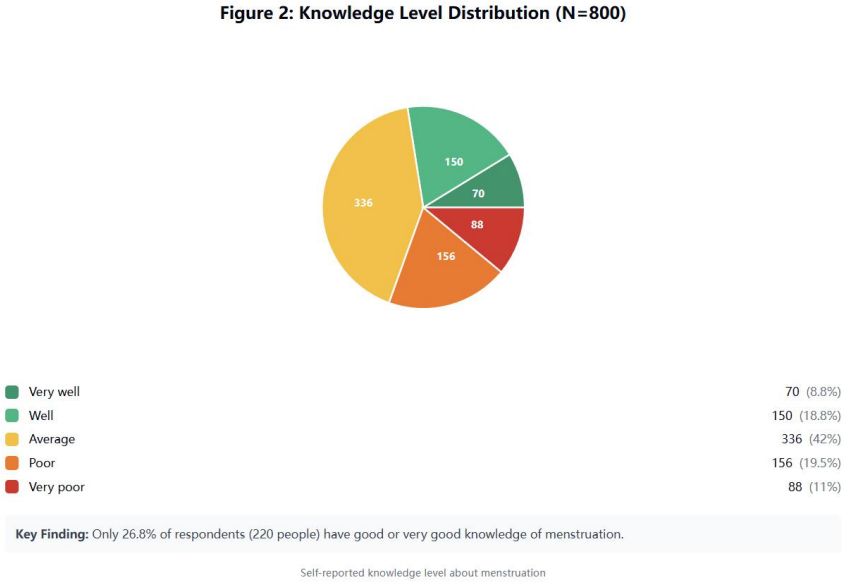

Figure 2: Knowledge Level Distribution

The distribution of the time when they first learned about menstruation knowledge showed that 63 people (7.9%) learned about it in or before the fourth grade of elementary school, 192 people (24.0%) learned about it in the fifth grade of elementary school, 241 people (30.1%) learned about it in the sixth grade of elementary school, 165 people (20.6%) learned about it in the first grade of junior high school, and 139 people (17.4%) learned about it after the first grade of junior high school. This shows that a considerable number of students lack sufficient knowledge preparation during the critical period of physiological development.

3.3 Evaluation of current school education

Only 37 people (4.6%) thought that the current menstrual education in schools was very sufficient, 145 people (18.1%) thought it was relatively sufficient, 234 people (29.3%) thought it was average, 216 people (27.0%) thought it was not sufficient, and 168 people (21.0%) thought it was completely insufficient. A total of 48.0% of the respondents believed that the current education was insufficient. The distribution of school education adequacy evaluation is shown in Figure 3.

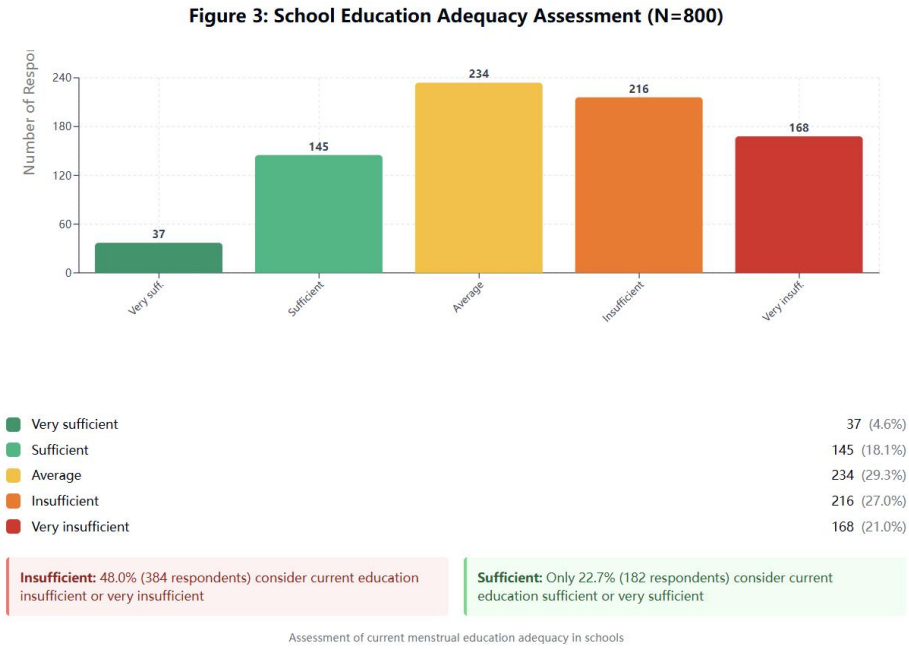

Figure 3: School Education Adequacy Assessment

Regarding whether the content of junior high school biology courses meets the needs, 69 people (8.6%) said they were fully satisfied, 155 people (19.4%) were basically satisfied, 237 people (29.6%) were partially satisfied, 214 people (26.8%) were not very satisfied, and 125 people (15.6%) were completely dissatisfied. Only 28.0% of the respondents were basically satisfied with the current course content.

3.4 Analysis of the needs for menstrual education

Regarding the necessity of opening a special menstrual education course in the upper grades of primary schools, 345 people (43.1%) thought it was very necessary, 258 people

(32.3%) thought it was relatively necessary, 118 people (14.8%) thought it was average, 39 people (4.9%) thought it was not very necessary, and 40 people (5.0%) thought it was completely unnecessary. A total of 75.4% of the respondents supported the opening of a special course. The distribution of the perception of the necessity of opening a course is shown in Figure 4.

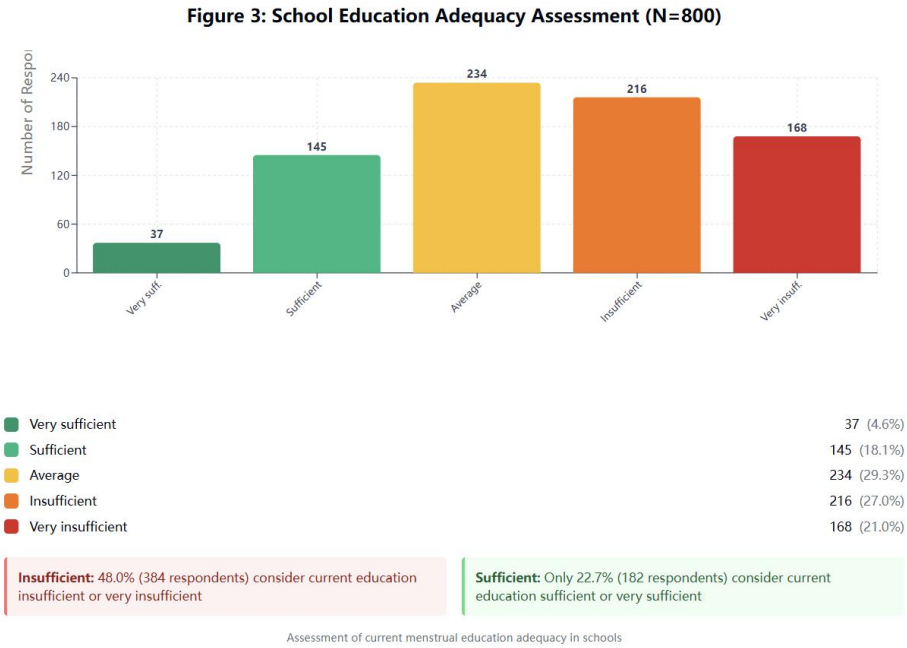

Figure 4: Course Necessity Perception

For the most appropriate grade for opening the course, 87 people (10.9%) chose the fourth grade of primary school, 276 people (34.5%) chose the fifth grade of primary school, 307 people (38.4%) chose the sixth grade of primary school, 90 people (11.3%) chose the first grade of junior high school, and 40 people (5.0%) thought it was not necessary. 72.9% of the respondents preferred to open it in grades 5-6 of primary school. The distribution of grade preferences is shown in Figure 5.

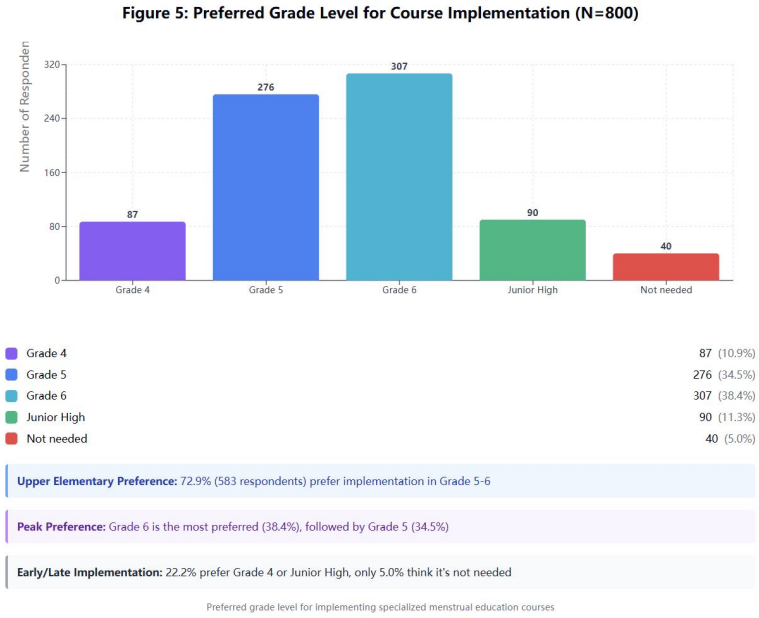

Figure 5: Course Necessity Perception

3.5 Preferences for educational content and forms

Regarding the educational content that they hope to include (multiple-choice questions), the percentage of choices from high to low is: 312 people (39.0%) on the physiological mechanism of menstruation, 151 people (18.9%) on hygiene care during menstruation, 170 people (21.3%) on how to use sanitary products correctly, and 167 people (20.9%) on eliminating menstrual shame and misunderstandings. This reflects the respondents' demand for comprehensive and systematic menstrual education.

Regarding the teaching form preference (multiple-choice questions), 383 people (47.9%) chose classroom lectures, 181 people (22.6%) chose to watch educational videos, 119 people (14.9%) chose group discussions, and 117 people (14.6%) chose practical demonstrations. Most respondents prefer diversified teaching methods.

3.6 Menstrual-related troubles

As for whether they have ever encountered troubles caused by insufficient knowledge of menstruation, 180 people (22.5%) often encountered it, 329 people (41.1%) occasionally encountered it, 170 people (21.3%) rarely encountered it, and 121 people (15.1%) never encountered it. A total of 63.6% of the respondents had experienced related troubles, indicating that lack of knowledge did bring practical problems. The frequency distribution of trouble experiences is shown in Figure 6.

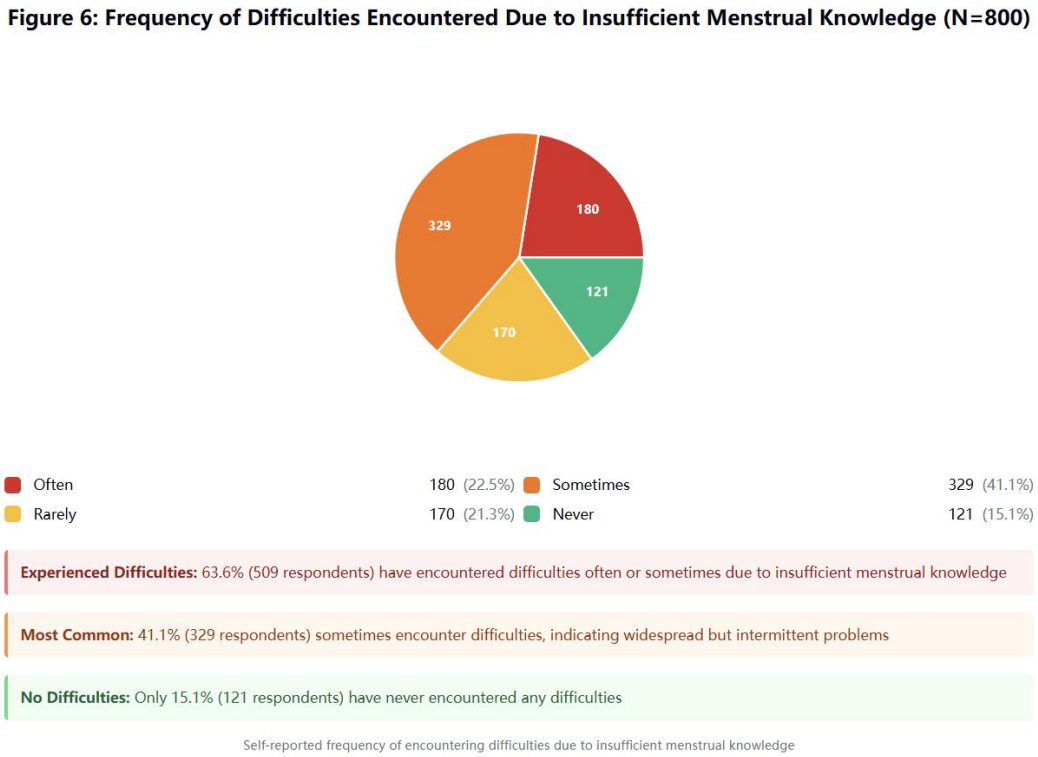

Figure 6: Course Necessity Perception

3.7 Help-seekers and suggestions for improvement

When encountering menstrual-related problems, the people who hope to seek help are: 316 parents/family members (39.5%), 141 teachers (17.6%), 167 friends/classmates (20.9%), 87 doctors (10.9%), and 89 online searches (11.1%). Family is still the main source of help.

Regarding the areas that need the most improvement in school, 178 people (22.3%) chose to increase education time, 183 people (22.9%) chose to enrich education content, 182 people (22.8%) chose to improve education methods, 144 people (18.0%) chose to train professional teachers, and 113 people (14.1%) chose to create an open atmosphere. The needs for improvement are relatively balanced.

4.Discussion

This study found that only 26.8% of the respondents had a good grasp of menstrual knowledge, which is significantly low (see Figure 2). What is more noteworthy is that a considerable number of students first learned about menstruation too late, and 17.4% of the respondents did not begin to learn about relevant knowledge until the first year of junior high school. Considering that the average age of menarche for girls in my country is about 12.5 years old, and there is a trend of early menarche (Chen et al., 2023), the lag in knowledge popularization is particularly prominent.

This lag is mainly due to the influence of traditional cultural concepts and the shortcomings of the existing education system. In traditional concepts, menstrual topics are regarded as private and even shameful, and families and schools lack the awareness of active education. The existing education system arranges menstrual content in junior high school biology classes, which is relatively late and has limited content, making it difficult to meet the actual needs of students.

The survey results show that 48.0% of the respondents believe that the current school menstrual education is insufficient, and only 28.0% are basically satisfied with the current course content (Figure 3). This shows that the current school menstrual education has problems in terms of content depth, breadth and timing.

The shortcomings of the existing education are mainly reflected in several aspects: First, the content is monotonous. The current education is mainly limited to a simple introduction to the physiological mechanism, lacking practical content such as psychological counseling, hygiene care, and the use of supplies. Second, the method is traditional. It is mainly based on one-way lectures by teachers, lacking interactivity and practicality, and it is difficult to mobilize students' enthusiasm. Third, the timing is lagging. The education arranged in the junior high school stage is too late for the senior elementary school students who have or are about to experience menarche.

This study shows that 75.4% of the respondents support the opening of a special menstrual education course in the senior grades of elementary school, and 72.9% prefer to open it in grades 5-6 of elementary school (Figure 4, Figure 5). This result fully illustrates the strong demand of society for early menstrual education.

Grades 5-6 of elementary school are the ideal time to carry out menstrual education. From the perspective of physiological development, this stage is in the budding period of puberty, and some female students may be about to or have experienced menarche, so timely knowledge preparation is crucial. From the perspective of psychological development, students in the upper grades of primary school have a certain level of understanding and acceptance, and can better master relevant knowledge. From the perspective of educational practice, carrying out education in primary school can avoid problems such as increased academic pressure and time constraints in junior high school.

The respondents' demand for educational content is diversified. They not only need knowledge of physiological mechanisms, but also strongly need practical content such as hygiene care, product use, and psychological counseling. This suggests that future menstrual education should adopt a comprehensive and systematic content system rather than being limited to the pure teaching of physiological knowledge.

Specifically, the ideal menstrual education content should include: (1) Physiological mechanism: basic knowledge such as the formation principle and cycle law of menstruation; (2) Hygiene care: practical skills such as personal hygiene and cleaning care during menstruation; (3) Product use: correct use methods and precautions of various hygiene products; (4) Mental health: emotional changes during menstruation, psychological adjustment methods, etc.; (5) Social cognition: eliminating menstrual shame and establishing correct social cognition.

The traditional teacher-led teaching model can no longer meet the learning needs of modern students. The survey shows that the respondents have high expectations for diversified teaching methods, including watching educational videos, group discussions, and practical demonstrations. This suggests that menstrual education should adopt more flexible and diverse teaching methods.

The advantages of diversified teaching methods are: (1) Improving participation: interactive teaching methods can better mobilize students' enthusiasm; (2) Enhancing practicality: practical demonstrations and other methods can improve students' practical ability; (3) Taking care of differences: different teaching methods can adapt to the learning preferences of different students; (4) Reducing sensitivity: diversified methods can help reduce the sensitivity and embarrassment of topics.

The survey results show that 18.0% of the respondents believe that training professional teachers is the most important aspect of school improvement. At present, most teachers lack

professional menstrual education training and are deficient in knowledge reserves, teaching skills, and psychological preparation. This directly affects the effectiveness and quality of education.

The teacher problem is mainly reflected in several aspects: First, the knowledge structure is incomplete. Many teachers only have basic physiological knowledge and lack interdisciplinary knowledge backgrounds such as psychology and education. Second, insufficient teaching skills. There is a lack of teaching methods and communication skills for sensitive topics. Thirdly, psychological preparation is insufficient. Some teachers themselves have psychological barriers to the topic of menstruation, making it difficult for them to teach naturally and openly.

It is worth noting that 63.6% of the respondents in this study had experienced troubles caused by insufficient knowledge of menstruation (Figure 6), which reflects the seriousness of the real problem from the side. At the same time, 75.4% of the respondents supported the establishment of special courses, indicating that social concepts are undergoing positive changes, providing favorable conditions for educational reform.

Traditional menstrual taboos are gradually being replaced by scientific and rational attitudes. The acceptance of menstrual education by parents and students is constantly improving, which has created a social foundation for carrying out systematic menstrual education in primary schools. The education department should seize this opportunity and actively promote relevant education reforms.

5.Policy recommendations

It is recommended that the education department include menstrual education in the primary school health education curriculum system and offer special menstrual education courses in grades 5-6 of primary school. The course content should cover multiple dimensions such as physiological mechanisms, hygiene care, mental health, and social cognition to form a complete knowledge system. At the same time, a unified curriculum standard and teaching outline should be formulated to ensure the scientific and systematic nature of the educational content.

Adopt diversified teaching methods, including classroom lectures, video teaching, group discussions, practical operations, expert lectures and other forms. Develop teaching resources suitable for the characteristics of primary school students, such as animated videos, interactive games, graphic manuals, etc. At the same time, modern information technology should be fully utilized to develop online education platforms to provide students with a more convenient learning path.

Establish a professional menstrual education teacher training system and conduct systematic training for relevant teachers. The training content should include professional knowledge, teaching skills, psychological counseling and other aspects. At the same time, it is possible to consider introducing off-campus professionals, such as doctors and psychological counselors, to provide professional support for school education.

Create an open and inclusive educational atmosphere to eliminate the mystery and shame of menstrual topics. Improve school facilities, such as equipping toilets with necessary sanitary products and setting up health consultation rooms. At the same time, home-school cooperation should be strengthened to guide parents to actively participate in menstrual education and form a collaborative education pattern between home and school.

Establish a scientific education effect evaluation system to regularly evaluate the implementation and effect of menstrual education. Comprehensively evaluate the effectiveness of education through student knowledge tests, attitude surveys, behavioral

observations, etc. At the same time, establish a supervision and feedback mechanism to promptly discover and solve problems in the education process.

6.Conclusion

Through the survey and analysis of 800 respondents, this study systematically revealed the current status and needs of menstrual education in the upper grades of primary schools. The study found that the current popularization rate of menstrual knowledge is low, the existing school education has obvious deficiencies, and the society has a strong demand for the establishment of special menstrual education courses in the upper grades of primary schools. Based on the research results, it is recommended to build a systematic curriculum system, innovate teaching methods, strengthen teacher construction, and improve the educational environment to meet the actual needs of students and parents and promote the physical and mental health development of adolescents.

Menstrual education is not only an important part of health education, but also an important way to promote gender equality and eliminate discrimination. With the change of social concepts and the renewal of educational concepts, menstrual education will surely usher in new development opportunities. The education department should actively respond to social needs, promote relevant education reforms, and contribute to the construction of a more scientific and complete adolescent health education system.

References

Chen, H., Liu, Z., Cheng, X., & Li, C. (2025). Dance of Fireworks: An Interactive Broadcast Gymnastics Training System Based on Pose Estimation. arXiv preprint arXiv:2505.02690.

Guo, F., Mo, H., Wu, J., Pan, L., Zhou, H., Zhang, Z., Li, L., & Huang, F. (2024). A hybrid stacking model for enhanced short-term load forecasting. Electronics, 13(14), 2719. https://doi.org/10.3390/electronics13142719

He, C., Zhang, Y., Liu, S., Wang, X., Chen, M., & Li, J. (2025). SCNet: Few-shot image classification via self-correlational and cross spatial-correlation attention. Engineering Science and Technology, an International Journal, 67, 102075.

Huang, X., Wang, L., Chen, M., & Zhang, Y. (2024). Research on older adults' interaction with e-health interface based on explainable artificial intelligence. In International Conference on Human-Computer Interaction (pp. 234-248). Springer Nature Switzerland.

Ji, C., Wang, Y., Liu, M., Zhang, X., & Chen, H. (2025). On the performance of artificial intelligence empowerment on consumer behavior. In 2025 5th International Conference on Informatization Economic Development and Management (IEDM 2025). Atlantis Press.

Li, C. (2024). Research on dynamic analysis and prediction model of tennis match based on Bayesian probability and analytic hierarchy process. arXiv preprint arXiv:2407.07116.

Li, C. (2025). Integrating LLM-based code optimization with human-like exclusionary reasoning for computational education. Journal of King Saud University – Computer and Information Sciences, 37, 87. https://doi.org/10.1007/s44443-025-00074-7

Li, C., Wang, Y., & Hu, F. (2024, July). Geometry-based multi-beam survey line layout problem. Journal of Physics: Conference Series, 2791(1), 012022. IOP Publishing.

Li, C., Weng, X., Li, Y., & Zhang, T. (2025). Multimodal learning engagement assessment system: An innovative approach to optimizing learning engagement. International Journal of Human–Computer Interaction, 41(5), 3474-3490.

Li, L., Chen, M., Wang, X., Zhang, Y., & Liu, S. (2024). Prototype comparison convolutional networks for one-shot segmentation. IEEE Access, 12, 45678-45692.

Li, L., Wang, Y., Chen, X., Zhang, M., Liu, H., & Zhao, J. (2025). Enhanced ResNet-50 for garbage classification: Feature fusion and depth-separable convolutions. PloS One, 20(1), e0317999.
Liu, Z., & Zhao, H. (2025). Research on the dynamic path of the "Bench Dragon" based on the spiral theorem and geometric reasoning. In Proceedings of the 4th International Conference on Computational Modeling, Simulation and Data Analysis (pp. 1034 – 1038). Association for Computing Machinery. https://doi.org/10.1145/3727993.3728163
Luo, J., Wang, X., Chen, Y., Zhang, L., Liu, M., & Li, H. (2025). Joint deep reinforcement learning strategy in MEC for smart internet of vehicles edge computing networks. Sustainable Computing: Informatics and Systems, 46, 101121.
Luo, W., Ma, S., Liu, X., Guo, X., & Xiao, C. (2024). JailBreakV: A benchmark for assessing the robustness of multimodal large language models against jailbreak attacks. arXiv preprint arXiv:2404.03027.
Luo, W., Ma, S., Liu, X., Guo, X., & Xiao, C. (2024). Jailbreakv-28k: A benchmark for assessing the robustness of multimodal large language models against jailbreak attacks. arXiv e-prints, arXiv-2404.
Ma, S., Luo, W., Wang, Y., & Liu, X. (2024). Visual-roleplay: Universal jailbreak attack on multimodal large language models via role-playing image character. arXiv preprint arXiv:2405.20773.
Ma, X., Chen, X., & Yuan, C. (2025). Crossroads of AI and tourism: Enhancing destination management and traveler engagement. In Proceedings of the 2025 2nd International Conference on Generative Artificial Intelligence and Information Security. ACM.
Ma, Y., Wang, J., Wang, F., Ma, S., Li, J., Pan, J., Liu, X., & Xiao, C. (2024). Benchmarking vision language model unlearning via fictitious facial identity dataset. arXiv preprint arXiv:2411.03554.
Mao, Z., Suzuki, S., Nabae, H., Miyagawa, S., Suzumori, K., & Maeda, S. (2025). Machine learning-enhanced soft robotic system inspired by rectal functions to investigate fecal incontinence. Bio-Design and Manufacturing, 8(3), 482-494.
Peng, Y., Sakai, Y., Funabora, Y., Yokoe, K., Aoyama, T., & Doki, S. (2025). Funabot-Sleeve: A wearable device employing McKibben artificial muscles for haptic sensation in the forearm. IEEE Robotics and Automation Letters.
Peng, Y., Yang, X., Li, D., Ma, Z., Liu, Z., Bai, X., & Mao, Z. (2025). Predicting flow status of a flexible rectifier using cognitive computing. Expert Systems with Applications, 264, 125878.
Rong, Y., Xu, M., & Li, R. (2025). EduFuncSum: A function-wise progressive transformer for code summarization in undergraduate programming education. Journal of King Saud University – Computer and Information Sciences, 37, 61. https://doi.org/10.1007/s44443-025-00075-6
Wang, J., Li, P., Ma, S., Wang, P., Liu, X., Sun, J., Chen, Y., & Xiao, C. (2024). Prompt injection benchmark for foundation model integrated systems. arXiv preprint.
Wang, Y., Chen, X., Liu, M., Zhang, H., Li, J., & Zhao, W. (2025). An efficient scheduling method in supply chain logistics based on network flow. Processes, 13(4), 969.
Wang, Y., Zhang, Y., Liu, S., & Li, C. (2024, July). Enhancing safety perception in autonomous driving systems through 3D object detection and neural network regression. In 2024 2nd International Conference on Algorithm, Image Processing and Machine Vision (AIPMV) (pp. 390-393). IEEE.
Xu, D., Wang, L., Chen, M., Zhang, Y., Liu, H., & Li, X. (2025). Multi-scale prototype convolutional network for few-shot semantic segmentation. PloS One, 20(4), e0319905.

Xu, L., Yuan, C., & Jiang, Z. (2025). Multi-strategy enhanced secret bird optimization algorithm for solving obstacle avoidance path planning for mobile robots. Mathematics, 13(5), 717.
Yu, S., Wang, X., Chen, L., Zhang, M., Liu, H., & Li, Y. (2025). CWMS-GAN: A small-sample bearing fault diagnosis method based on continuous wavelet transform and multi-size kernel attention mechanism. PloS One, 20(4), e0319202.
Zhang, J., Liu, M., Deng, W., Zhang, Z., Jiang, X., & Liu, G. (2024). Research on electro-mechanical actuator fault diagnosis based on ensemble learning method. International Journal of Hydromechatronics, 7(2), 113-131.
Zhang, X., Wang, L., Chen, M., Liu, Y., Zhao, H., & Li, J. (2023). A brief survey of machine learning and deep learning techniques for e-commerce research. Journal of Theoretical and Applied Electronic Commerce Research, 18(4), 2188-2216.
Zheng, L., Wang, Y., Chen, X., Zhang, M., Liu, H., & Li, J. (2025). A mean field game integrated MPC-QP framework for collision-free multi-vehicle control. Robotics and Autonomous Systems.
Zhou, J., Wu, Y., Zhang, Y., Chen, X., Liu, M., & Wang, H. (2025). SemIRNet: A semantic irony recognition network for multimodal sarcasm detection. In 2025 10th International Conference on Information and Network Technologies (ICINT) (pp. 158-162). IEEE.