RESEARCH PAPER

Effectiveness of a Problem-Based Learning & Module (PBLM) on Knowledge Regarding Protein Energy Malnutrition among Mothers of Under-Five Children in a Rural Area of Amroha, Uttar Pradesh

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ABSTRACT

Background: Protein Energy Malnutrition (PEM) remains one of the leading causes of morbidity and mortality among under-five children, particularly in rural communities where maternal awareness regarding child nutrition is limited. Educational interventions targeting mothers play a crucial role in preventing malnutrition. **Objective:** To determine the effectiveness of PBLM on knowledge regarding Protein Energy Malnutrition among mothers of under-five children in a selected rural area of Amroha, Uttar Pradesh .**Methods:** A quantitative pre-experimental one-group pre-test post-test research design was adopted. The study was conducted among 35 mothers of under-five children selected using non-probability purposive sampling. Data were collected using a self-structured, validated knowledge questionnaire. Baseline knowledge was assessed through pre-test, followed by administration of a Problem-Based Learning Module covering causes, signs and symptoms, prevention, and dietary management of PEM. Post-test assessment was conducted after one day. Data were analyzed using descriptive statistics and inferential statistics including paired t-test, ANOVA and chi-square test and other parametric and non-parametric tests. **Results:** Pre-test findings revealed that 82.86% of mothers had poor knowledge and none had good knowledge regarding PEM. Post-test results showed marked improvement, with 60% demonstrating average knowledge and 40% good knowledge. The mean knowledge score increased from 6.80 ± 2.63 to 16.34 ± 3.66. The calculated paired t-value (16.09) was statistically significant at $p < 0.001$, indicating the effectiveness of the Problem-Based Learning Module. **Conclusion:** The Problem-Based Learning Module was highly effective in improving maternal knowledge regarding Protein Energy Malnutrition. Incorporating structured nutrition education into community health services can contribute significantly to prevention of malnutrition and promotion of child health in rural populations.

Keywords: Protein Energy Malnutrition, Problem-Based Learning Module, Maternal Knowledge, Under-Five Children, Rural Health, Nutrition Education.

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INTRODUCTION

Protein Energy Malnutrition (PEM) remains one of the most critical public health challenges confronting under-five children globally, particularly in resource-constrained settings of low- and middle-income countries. According to the World Health Organization (WHO), undernutrition, encompassing PEM, contributes to approximately 45% of all deaths among children under five years of age, translating to over 3 million preventable deaths annually.[1]This staggering burden is exacerbated by the synergistic effects of malnutrition with infectious diseases, leading to vicious cycles of morbidity, impaired growth, and mortality. In India, the situation is particularly dire; the National Family Health Survey-5 (NFHS-5, 2019-21) documents that 35.5% of under-five children are underweight, 32.1% are stunted, and 19.3% are wasted, with rural areas exhibiting disproportionately higher rates compared to urban counterparts.[2]These figures underscore India's struggle to meet Sustainable Development Goal 2.2, which targets ending all forms of malnutrition by 2030, despite large-scale national initiatives like the Integrated Child Development Services (ICDS), Mid-Day Meal Scheme, and Poshan Abhiyaan.[3]

PEM represents a spectrum of pathological conditions arising from imbalances in energy and protein intake relative to physiological needs. At one end lies chronic under nutrition, characterized by stunting (linear growth retardation), which affects cognitive development and economic productivity into adulthood. Acute malnutrition manifests as wasting (low weight-for-height), signalling immediate life-threatening energy deficits. Severe forms include marasmus, marked by extreme caloric deprivation leading to emaciation, muscle wasting, and loss of subcutaneous fat, and kwashiorkor, distinguished by hypoalbuminemic oedema, flaky dermatosis, and hepatomegaly due to predominant protein deficiency.[4] These conditions compromise cellular immunity, increasing susceptibility to diarrhea, pneumonia, and measles—common killers in malnourished children. Long-term sequelae extend beyond physical health, encompassing neuro developmental delays, reduced school performance, and perpetuation of intergenerational poverty cycles.[5]The etiology of PEM is multifactorial, involving immediate causes (inadequate dietary intake and disease), underlying determinants (household food insecurity, suboptimal childcare practices), and basic structural factors (poverty, poor sanitation, gender inequities)[6]. In rural India, where over 65% of the under-five population resides, these intersect with cultural feeding taboos, delayed complementary feeding, and inadequate breastfeeding promotion. Maternal factors are pivotal: mothers serve as primary decision-makers for infant feeding, hygiene, and healthcare-seeking. Yet, studies consistently reveal profound knowledge deficits among rural mothers regarding PEM recognition (e.g., interpreting pitting oedema or growth faltering as normal), prevention strategies (e.g., exclusive breastfeeding for six months, micronutrient-rich complementary foods), and management (e.g., timely referral for severe acute malnutrition).[7,8] For instance, a cross-sectional survey in Uttar Pradesh found that only 28% of mothers could identify early PEM signs, correlating with higher wasting prevalence in their children.[9]

Despite robust policy frameworks, implementation gaps persist. ICDS Anganwadi centers, intended to deliver nutrition counseling, often suffer from overburdened staff, inconsistent supplementary feeding, and low maternal attendance. Supplementary nutrition reaches only 60-70% of eligible beneficiaries, with quality issues further diluting impact.[10]

Community health workers like ASHA and ANM provide sporadic education, but lack standardized, interactive modules tailored to local contexts. This underscores the need for targeted, evidence-based educational interventions that empower mothers as change agents in PEM prevention.

Problem-Based Learning Modules (PBLMs)) emerge as promising strategies within nursing-led community health paradigms. These modules employ adult learning principles—combining lectures, discussions, visual aids, demonstrations, and culturally adapted content—to address PEM comprehensively: etiology (macro/micronutrient deficiencies, infections), clinical features (anthropometric indices, danger signs), prevention (growth monitoring, hygiene), and management (home-based rehabilitation, referral protocols).[11]Empirical evidence supports their efficacy; a quasi-experimental study in rural Maharashtra reported a 25-point mean knowledge score gain post-STP ($p<0.001$), sustained at three-month follow-up.[12]Similarly, interventions in Odisha and Rajasthan demonstrated shifts from 80-90% poor baseline knowledge to 60-70% good/adequate post-intervention levels.[13,14]However, much of this evidence derives from southern and eastern India, with limited data from northern rural belts like Uttar Pradesh, where agro-climatic and socio-cultural factors may modulate intervention outcomes.

This pre-experimental one-group pretest-post-test study was thus undertaken to assess the effectiveness of a PBLM on knowledge regarding PEM among mothers of under-five children in Village Dariyapur, Amroha district, Uttar Pradesh—a rural area with high under nutrition prevalence and low maternal literacy. By

quantifying knowledge gains and exploring demographic associations, the study aims to generate actionable evidence for integrating PBLMs into routine maternal-child health services, ultimately contributing to PEM reduction and child survival.

MATERIAL AND METHOD

2.1 Research Design

A pre-experimental one-group pre-test post-test design was adopted to evaluate the effectiveness of a Problem-Based Learning Module on maternal knowledge regarding protein energy malnutrition (PEM). This design was chosen as it allows measurement of knowledge before and after the intervention within the same group, thereby highlighting the impact of the teaching program.

2.2 Study Design and Research Approach

A quantitative research approach was adopted using a pre-experimental one-group pre-test post-test design to evaluate the effectiveness of a Problem-Based Learning Module (PBLM) on knowledge regarding Protein Energy Malnutrition (PEM) among mothers of under-five children. This design enabled assessment of baseline knowledge and measurement of knowledge gain following the educational intervention.

2.3 Study Setting

The study was conducted in Village Dariyapur Dist-Amroha district, Uttar Pradesh, India. The area was chosen due to the presence of a considerable population of under-five children and feasibility of conducting community-based educational sessions.

2.4 Study Population and Sample

The study population comprised mothers having at least one child below five years of age residing in the selected rural area. A total of 35 mothers were included in the study. Participants were selected using a non-probability purposive sampling technique based on predefined eligibility criteria.

Inclusion Criteria

- Mothers having at least one child below five years of age
- Residents of the selected rural area
- Mothers willing to participate in the study
- Mothers able to understand Hindi

2.5 Development of Data Collection Tool

Data were collected using a **self-structured knowledge questionnaire** developed after extensive review of literature, national nutrition guidelines, and consultation with subject experts in Community Health Nursing and Pediatrics.

The questionnaire consisted of two sections:

Section I: Demographic variables (Age, education, occupation, type of family, number of children, etc.)

Section II: Knowledge regarding PEM, including: Definition and types, Causes and risk factors, Signs and symptoms (marasmus, kwashiorkor), Preventive measures, Dietary management, Role of mothers in prevention

2.6 Validity and Reliability

Content validity of the tool was established through expert evaluation by nursing faculty and paediatric specialists. Necessary modifications were incorporated based on their suggestions. Reliability was tested through pilot administration, and internal consistency of the tool was found to be satisfactory for use in the main study.

Pilot Study

A pilot study was conducted on a small sample of mothers from a similar rural setting to assess feasibility, clarity, and applicability of the tool and teaching programme. Based on pilot findings, minor modifications were made before final data collection.

2.7 Intervention: Problem-Based Learning Module

The **Problem-Based Learning Module**was developed to improve maternal knowledge regarding PEM. The session included:

- Meaning and causes of PEM
- Clinical manifestations
- Preventive strategies
- Breastfeeding and complementary feeding
- Balanced diet and hygiene

Teaching strategies included lecture-cum-discussion, visual aids, charts, and demonstrations. The session duration was approximately **40–45 minutes** and was delivered in the local language for better comprehension.

2.8 Data Collection Procedure

Data collection was conducted in three phases:

Phase I — Pre-test: Baseline knowledge was assessed using the structured questionnaire.

Phase II — Intervention: The Problem-Based Learning Module was administered immediately after the pre-test.

Phase III — Post-test: Post-test assessment was conducted after one week using the same questionnaire to evaluate knowledge gain.

2.9 Statistical Analysis

Data were entered and analyzed using descriptive and inferential statistics.

- **Descriptive statistics:** Frequency, percentage, mean, and standard deviation
- **Inferential statistics:** Paired t-test to compare pre- and post-test scores; Chi-square test to determine association between knowledge and demographic variables. A p-value < 0.05 was considered statistically significant.

2.10 Ethical Considerations

Ethical approval was obtained from the institutional ethics committee. Informed consent was secured from all participants prior to data collection. Confidentiality and anonymity of respondents were maintained throughout the study.

RESULTS

3.1 Demographic Characteristics

Table 1 presents the demographic profile of the 35 participating mothers. The majority were between 21–30 years of age, with primary or secondary education, and most were homemakers. More than half belonged to nuclear families, and nearly half had two children.

Table 1: Frequency and Percentage distribution among mother of (under five children) with selected demographic variables.

S. No	Demographical Variable	Category	Frequency	Percentage (%)
1	Age in years	22–26	13	37.14
		27–30	13	37.14
		31–34	3	8.57
		Above 35	6	17.14
2	Education	No formal education	3	1.57
		Primary	14	40
		Secondary	13	37.14
		Intermediate	5	14.28
3	Occupation	Housewife	21	60
		Self-employed	9	25.71
		Pvt. job	5	14.28
4	Education of Husband	No formal education	9	25.71
		Up to 5th	8	22.85
		Up to 10th	11	31.42
		Up to 12th	7	20
5	Occupation of Husband	Farmer	10	28.57
		Labourer	17	48.57
		Pvt. job	6	17.14
		Govt. job	2	5.71
6	Type of Family	Nuclear	21	60
		Joint	14	40
7	No. of Children (Under 5 Years)	One	7	20
		Two	14	40
		More than two	14	40

8	Age of Youngest Child (Months)	Below 6	7	20
		6–12	17	48.57
		13–24	11	31.42
9	Participation in Anganwadi / Health Education Programme	Yes	20	57.14
		No	15	42.85

3.2 Baseline Knowledge Regarding Protein Energy Malnutrition

Pre-test findings revealed that the majority of mothers had inadequate knowledge regarding Protein Energy Malnutrition (PEM). Out of 35 participants, 29 (82.86%) had poor knowledge and 6 (17.14%) had average knowledge. None of the mothers' demonstrated good knowledge in the pre-test assessment.The mean pre-test knowledge score was **6.80 ± 2.63**, indicating low baseline awareness regarding causes, signs and symptoms, prevention, and management of PEM.

3.2 Post-Intervention Knowledge

Following the administration of the Problem-Based Learning Module (PBLM), a substantial improvement in knowledge scores was observed. In the post-test assessment, 21 (60%) mothers demonstrated average knowledge and 14 (40%) demonstrated good knowledge. No participant remained in the poor knowledge category.

The mean post-test knowledge score increased to **16.34 ± 3.66**, reflecting considerable knowledge gain after the intervention.

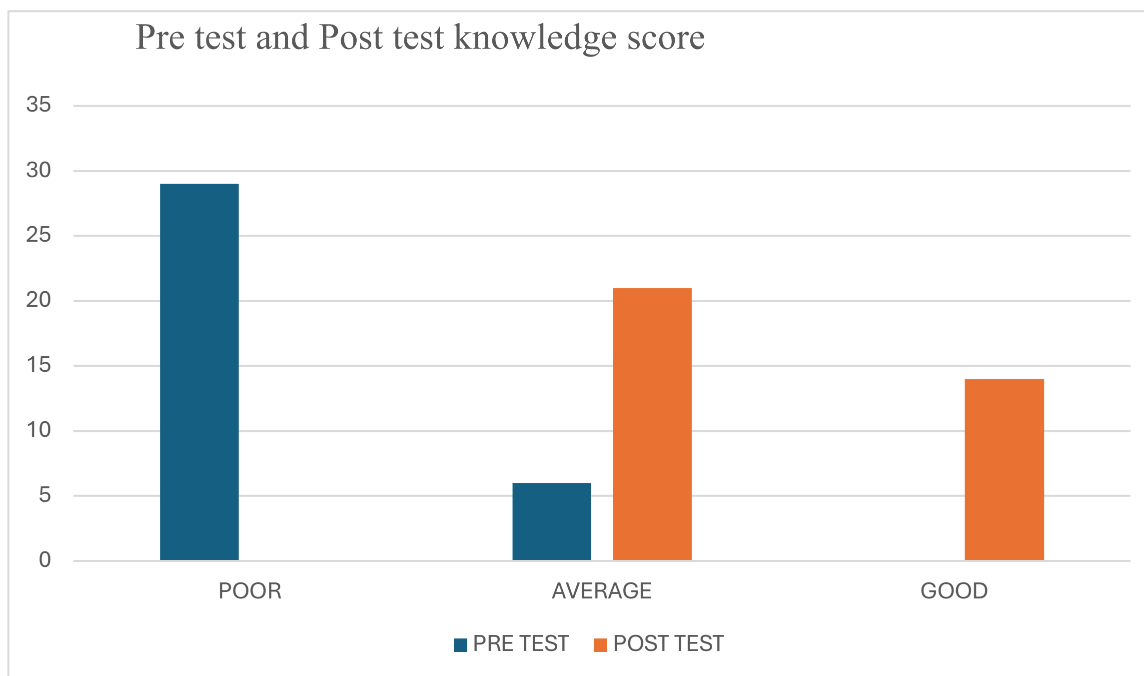

Figure 1 – Pretest and Post test knowledge score of mothers of under five children regarding PEM

3.3 Effectiveness of Problem-Based Learning Module

Table 2-Comparison of Pre-test and Post-test Knowledge Scores of Participants

n= 35

Variables	Mean ± SD	Min	Max	Calculated t-value	Table t-value	p-value
Pre-test Score	**6.80 ± 2.63**	**3**	**15**	**16.09**	**2.032 (df = 34)**	**< 0.001***
Post-test Score	**16.34 ± 3.66**	**10**	**24**			

*Significant at $p < 0.05$ (Paired t-test)

Comparison of pre-test and post-test mean knowledge scores showed a statistically significant improvement

following the educational intervention. The calculated paired t-value was **16.09**, which was greater than the table value of 2.032 at 0.05 level of significance (df = 34).

The difference between pre-test and post-test scores was statistically highly significant (**$p < 0.001$**), indicating that the Problem-Based Learning Module was effective in improving maternal knowledge regarding Protein Energy Malnutrition.

3.4 Association Between Knowledge and Demographic Variables

Chi-square analysis was performed to determine the association between pre-test knowledge scores and selected demographic variables. No statistically significant association was found between knowledge level and age, education, occupation, husband's education, husband's occupation, type of family, number of children, age of youngest child, or participation in Anganwadi/health programmes ($p > 0.05$).

These findings suggest that inadequate baseline knowledge regarding PEM was prevalent across all demographic categories.

Table no 3.4 : **Association between pretest level of knowledge and selected demographical variables.**

n= 35

Demographic variables	Level of knowledge		df	Chi- square	P-value
	AVERAGE	POOR			
1.AGE					
22 to 26	3	10	6	0.97	0.98
27 to 30	2	11			
31 to 34	0	3			
Above 35	1	5			
2.EDUCATION					
No formal	0	3	6	2.6	0.85
Primary	2	12			
Secondary	2	11			
intermediate	2	3			
3.OCCUPATION					
Housewife	3	17	4	2.96	0.56
Self employed	3	6			
Pvt. job	0	6			
4. EDUCATION OF HUSBAND					
No formal	1	8	6	3.37	0.76
Up to 5th	3	5			
Up to 10th	2	9			
Up to 12th	0	7			
5. OCCUPATION OF HUSBAND					
Farmer	2	8	6	0.4	0.99
Labourer	3	14			
Pvt. job	1	5			
Govt. job	0	2			

6. TYPE OF FAMILY					
Nuclear	3	18	2	0.3	0.86
Joint	3	11			
7. NO. OF CHILDREN(UNDER 5 YEARS					
One	1	7	4	0.52	0.97
Two	3	10			
More than	2	12			
8. AGE OF YOUNGEST CHILD (in month)					
Below 6	2	5	4	0.99	0.91
6-12	2	15			
13-24	2	9			

DISCUSSION

The present study aimed to evaluate the effectiveness of a Problem-Based Learning Module on knowledge regarding Protein Energy Malnutrition (PEM) among mothers of under-five children in a rural area of Amroha. The findings are discussed in comparison with previous research.

4.1 Baseline Knowledge in Comparison with Other Studies

The present study revealed that the majority of mothers (82.86%) had poor knowledge regarding PEM in the pre-test assessment. This indicates that awareness regarding causes, signs, prevention, and management of PEM was inadequate among mothers in the selected rural area.

These findings are consistent with the study conducted by **Masih and Linson**, who reported that 90% of mothers had inadequate knowledge before the educational intervention. Similarly, **Sharma et al. (2019)** found that 80% of mothers had insufficient knowledge regarding prevention of PEM. **Thongam et al. (2017)** also observed moderate to poor knowledge among mothers attending a hospital in Meerut.

The similarity across studies suggests that maternal knowledge deficits regarding PEM remain prevalent in both rural and semi-urban settings in India. Poor awareness may be linked to limited educational exposure, socioeconomic constraints, and inadequate utilization of community health services.

4.2 Effectiveness of Problem-Based Learning Module: Comparison with Other Studies

In the present study, post-test results demonstrated significant improvement in maternal knowledge following the Problem-Based Learning Module. None of the mothers remained in the poor knowledge category, and 40% achieved good knowledge levels. The mean knowledge score increased significantly ($p < 0.001$).

These findings are strongly supported by previous intervention studies:

- **Bhardwaj et al. (2017)** reported a statistically significant improvement in post-test knowledge scores ($p < 0.05$) after administering a structured teaching programme on malnutrition.
- **Roul et al. (2022)** observed a substantial increase in knowledge scores following a self-instructional module on PEM among mothers in Odisha.
- **Kale et al. (2019)** also found significant improvement in maternal knowledge after planned health teaching intervention ($p < 0.005$).
- **Masih and Linson** reported that 78% of mothers demonstrated moderately adequate knowledge after STP administration.

The consistent improvement across studies confirms that Problem-Based Learning Module are effective tools for enhancing maternal awareness regarding child nutrition and malnutrition prevention.

The magnitude of improvement in the present study (mean increase from 6.80 to 16.34) appears comparatively higher than some previous studies, which may be attributed to focused content delivery, small sample size allowing individualized attention, and use of visual aids during teaching sessions.

4.3 Comparison Regarding Association with Demographic Variables

The present study found no statistically significant association between baseline knowledge and selected demographic variables such as age, education, occupation, and family type.

4.4 However, this finding differs from some previous studies:

- **Nanadaprakash et al. (2005)** reported a significant association between maternal education and knowledge regarding PEM.
- **Sharmila (2022)** found that maternal education and type of family were significantly associated with knowledge levels.
- **Sinaga et al. (2021)** observed a significant relationship between maternal knowledge and nutritional status of children ($p = 0.001$).

4.5 Strengths and Limitations of the Study

The present study possesses several methodological strengths. It was conducted in a rural community setting, thereby enhancing the practical applicability of the findings in real-life maternal and child health programmes. The Problem-Based Learning Module was systematically planned and covered all major aspects of Protein Energy Malnutrition, including causes, clinical features, preventive measures, and dietary management, ensuring comprehensive knowledge delivery. The use of a pre-experimental one-group pre-test post-test design enabled direct assessment of knowledge gain following the intervention. The application of both descriptive and inferential statistical methods added scientific rigor to the analysis. Additionally, the intervention module is simple, feasible, and easily replicable by community health professionals in similar settings.

However, the study also has certain limitations. The sample size was relatively small, involving only 35 mothers, which may limit the generalizability of the findings. The absence of a control group restricts the ability to attribute the observed knowledge improvement exclusively to the Problem-Based Learning Module. The post-test was conducted after a short interval, which did not permit assessment of long-term knowledge retention or behavioral change. The study was geographically limited to a single rural village of Amroha district, thereby affecting external validity. Although the tool was validated, reliance on a self-structured questionnaire may introduce response bias. Moreover, the study focused solely on knowledge assessment and did not evaluate actual feeding practices or nutritional status outcomes among children.

4.6 Recommendations

Based on the findings of the present study, several recommendations are proposed. Similar studies may be conducted on a larger sample to enhance generalizability of results. A true experimental design with a control group is recommended to establish stronger causal relationships. Long-term follow-up studies should be undertaken to assess retention of knowledge and translation into feeding practices. Future research may evaluate the effectiveness of structured teaching programmes on actual nutritional status and growth outcomes of under-five children. Comparative studies between rural and urban mothers may provide deeper insights into contextual determinants of malnutrition. Integration of audiovisual and digital teaching methods should also be explored to enhance learning outcomes. Furthermore, interventional studies involving fathers and other caregivers are recommended, as child nutrition is influenced by overall family practices.

4.7 Nursing Implications

The findings of the present study have important implications for nursing practice, education, administration, and research. Community health nurses play a pivotal role in prevention and early identification of Protein Energy Malnutrition among under-five children. Problem-Based Learning Module can be incorporated into routine nursing activities such as home visits, immunization clinics, growth monitoring sessions, and Village Health and Nutrition Days. Nurses should actively educate mothers regarding breastfeeding, complementary feeding, balanced diet, hygiene, and early warning signs of malnutrition. In nursing education, greater emphasis should be placed on developing students' competencies in nutrition counseling and community teaching strategies. Nurse administrators should organize regular in-service education and outreach nutrition programmes in collaboration with ICDS and primary healthcare services. The study also highlights the need for nurses to engage in community-based research focusing on preventive child health and nutrition promotion.

CONCLUSION

Protein Energy Malnutrition continues to be a major public health challenge among under-five children, particularly in rural communities where maternal knowledge regarding child nutrition remains inadequate. The present study identified poor baseline awareness among mothers regarding various aspects of Protein Energy Malnutrition, including its causes, signs and symptoms, prevention, and management. Following the implementation of the Structured Teaching Programme, a statistically significant improvement in maternal knowledge was observed, demonstrating the effectiveness of the educational intervention. These findings highlight the critical role of structured health education in empowering mothers with essential nutritional knowledge that can contribute to early identification and prevention of malnutrition. Integrating Problem-Based Learning Module into routine community health services such as Anganwadi programmes, immunization clinics, and village health campaigns can serve as a cost-effective strategy to combat malnutrition. Strengthening maternal education

through continuous, culturally appropriate health teaching initiatives can significantly improve child health outcomes and reduce the burden of Protein Energy Malnutrition in rural populations.

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Conflict of Interests
No conflict of interest was reported by the author.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process
During the preparation of this manuscript, the author used AI-assisted tools for language editing and formatting purposes only. The author reviewed and edited the content as needed and takes full responsibility for the accuracy, originality, and integrity of the work.

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