INTRODUCTION

Background and Rationale

Menstruation, despite being a natural and recurring biological process, continues to be surrounded by cultural taboos and social discomfort in many parts of the world, including India. Conversations around menstruation are often relegated to private spaces, with little to no visibility in public or institutional contexts. Within universities, spaces that are expected to encourage dialogue, inclusivity, and critical thinking, discussions on menstruation often remain limited, stigmatized, or awkwardly avoided. The absence of open communication perpetuates misinformation, shame, and unequal participation among menstruating individuals.

This study seeks to explore how university students perceive and engage with conversations about menstruation within academic environments. Specifically, it aims to identify whether students feel comfortable discussing menstruation in classrooms, peer groups, and among faculty, as well as what underlying sentiments and themes emerge from their responses. By applying **Natural Language Processing (NLP)** techniques to interview transcripts, this study bridges qualitative inquiry and computational text analysis, transforming subjective perceptions into structured, data-driven insights for institutional decision-making.

Dataset Description

The dataset for this study comprises a folder named **"Transcripts"**, located on the researcher's desktop, which includes multiple interview files. Each file represents an individual interview conducted with university students across diverse disciplines and gender identities. The interviews were semi-structured, allowing participants to elaborate freely on their experiences and attitudes regarding menstruation-related discussions in academic settings.

Each transcript follows a consistent question-answer (Q&A) format with five open-ended questions designed to elicit nuanced emotional and cognitive responses:

1. **Q1: How openly is menstruation discussed among students and faculty in your college or university?**
   This question can reveal the overall *visibility and openness* of menstrual conversations within academic spaces, indicating whether the topic is normalized or remains taboo.

2. **Q2: Do you personally feel comfortable talking about menstruation with your peers, professors, or in classroom discussions? Why or why not?**
   Responses here reflect *individual comfort levels* and help identify *psychological or social barriers* (e.g., fear of judgment, gender dynamics) influencing open dialogue.

3. **Q3: What kind of reactions or attitudes do you observe when menstruation is mentioned in mixed-gender or public academic settings?**
   This explores *social attitudes and gendered perceptions*, offering insight into how societal norms and peer behaviours shape discourse around menstruation.

4. **Q4: Do you think universities should play a more active role in promoting menstrual awareness and inclusion (e.g., seminars, policies, facilities)? Why or why not?**
   This highlights students' *expectations from institutional support*, revealing perceived gaps in awareness programs, infrastructure, and inclusive policies.

5. **Q5: What changes would make academic spaces more comfortable and inclusive for open conversations about menstruation?**
   Responses can point to *actionable recommendations*, such as the need for awareness campaigns, gender-sensitivity training, or improved facilities, shaping managerial and policy-level decisions.

These responses collectively form a qualitative dataset rich in emotional content, personal experiences, and social observations, ideal for **sentiment analysis** and **thematic exploration**. The participants' words not only reveal their comfort levels but also reflect institutional culture, gender dynamics, and the broader discourse on menstrual inclusivity.

Objective and Relevance

The primary objective of this research is to analyse the **sentiments** (positive, negative, or neutral) expressed by university students regarding menstruation-related discussions, and to identify the **emerging themes** that represent collective attitudes or barriers. Through this, the study seeks to uncover the underlying social and emotional dimensions that influence menstrual discourse in higher education.

While menstruation has been increasingly discussed in feminist literature and public health research, its representation within academic institutions, particularly from the perspective of students, remains underexplored. This study, therefore, not only contributes to the understanding of gender sensitivity in educational spaces but also informs university administrators and policymakers about existing communication barriers and potential inclusivity strategies.

The relevance of this topic extends beyond gender studies or health awareness; it aligns with **Sustainable Development Goal 5 (Gender Equality)** and broader institutional commitments toward inclusivity and well-being. Universities serve as microcosms of society; the openness with which students can discuss menstruation reflects broader cultural progress toward destigmatization and equity.

Methodological Overview

The research adopts a **qualitative-computational approach**, leveraging Natural Language Processing to systematically analyse interview transcripts. The process is divided into two major parts:

- **Part   A: Sentiment   Analysis**
  The textual responses were pre-processed using tokenization, stop word removal, and lemmatization. The cleaned text was then converted into numerical form using **TF-IDF vectorization**, followed by supervised machine learning models ,to classify sentiments into **positive**, **negative**, or **neutral** categories. This allowed quantification of emotional tones associated with menstruation discourse in academic spaces.

- **Part   B: Thematic   Analysis   (Topic   Modelling)**
  To identify broader ideas and recurring issues, unsupervised learning techniques such as **K-Means clustering** and **Latent Dirichlet Allocation (LDA)** were applied on TF-IDF representations of the text. Each cluster or topic was then labelled based on its dominant keywords and contextual interpretation, for instance, themes such as *institutional support*, *peer attitudes*, or *gendered discomfort*.

Finally, the results from both analyses were integrated into a **dashboard visualization**, enabling interpretation of how sentiments vary across different themes. This approach demonstrates how qualitative data, traditionally analysed through manual coding, can be enhanced and validated through data-driven methods.

Expected Contributions

This project contributes in three major ways:

1. **Empirical Insight:** It provides evidence-based understanding of how students perceive menstrual discourse in university environments.
2. **Methodological Advancement:** It showcases the potential of **machine learning in social research**, particularly how NLP can enhance traditional thematic analysis.
3. **Managerial Implications:** It offers actionable recommendations for universities to foster inclusivity through policy, curriculum design, and awareness programs.

By integrating sentiment and thematic analyses, this study aims to present a comprehensive picture of the current landscape of menstrual discourse in academic spaces. Understanding students' comfort levels, emotional responses, and perceived barriers will enable institutions to implement more inclusive practices and normalize conversations around menstruation, thereby fostering empathy, awareness, and equality within the educational ecosystem.

LITERATURE REVIEW

Menstruation is a natural and universal biological process, yet remains one of the most stigmatized topics within educational environments worldwide. Studies consistently report that university and college students, across numerous countries, feel varying degrees of discomfort, embarrassment, and reluctance discussing menstruation in classrooms and on campus, often due to entrenched gender norms, lack of institutional support, inadequate infrastructure, and ongoing cultural taboos. The following literature review synthesizes findings from peer-reviewed research spanning the last two decades, including relevant insights from adolescent, high school, and young adult populations where university-specific evidence is limited.

Comfort Levels & Stigma

Low Confidence on Campus
Research consistently demonstrates a stark disparity between how students feel managing menstruation at home versus on campus. Large surveys in the US and Australia show only 14–16% of menstruators feel completely confident managing their periods at university, compared to nearly 90% at home. Concerns include inadequate facilities, fear of social stigma, lack of product availability, and poor bathroom privacy.

Discussion Discomfort and Selective Disclosure
Most students (66–70%) report being comfortable discussing periods with peers or female family members, but very few are at ease discussing menstruation with male peers, teachers, or authority figures. Only about 7% of surveyed students felt comfortable talking with university staff or employers about menstruation, while in high school settings, students, especially those from cultures with strong taboos, limit such conversations to close female friends or relatives.

Stigma and Secrecy
Menstrual stigma is universal but culturally variable. Across studies in Africa and South Asia, students describe the monthly experience as something to be hidden due to shame or "pollution," with concealment encouraged by educators, family, and peers. Boys and men are often specifically excluded from menstrual discussions, and fear of teasing by male classmates is common, over 80% of girls in Tanzania feared being teased if their period was discovered at school. Period teasing, jokes, and negative labels are widespread in secondary schools.

Educational Impact

Absences and Lost Educational Time
Menstrual symptoms are a leading reason for missed classes and participation gaps; university surveys in the UK, US, and India report that menstruators miss an average of 10 study days yearly due to menstrual symptoms, with this number doubling for those with chronic menstrual disorders. Presenteeism, being physically present but unable to concentrate or participate due to pain or anxiety, is even more prevalent, affecting up to 70% of menstruating students.

Campus Facilities as Barriers
Lack of sanitary and private facilities exacerbates both physical and psychological discomfort. Up to half of students in some contexts avoid changing products on campus, with many worried about being seen, a lack of supplies, or unsanitary bathrooms. These issues are especially acute for students unable to afford menstrual products ("period poverty") and for those using reusable products needing access to water and private spaces.

Inequitable Impact
Stigma and infrastructure gaps disproportionately affect students from lower-income backgrounds, racial/ethnic minorities, and international/migrant students. Transgender and gender-diverse students face additional anxieties, including dysphoria, lack of inclusive product provision, and bathroom access concerns, but are rarely included in research or policy design.

Educational and Institutional Responses

Menstrual Health Education
School- and college-based education is often limited to biological or reproductive aspects, omitting practical or emotional dimensions of menstrual health. Interactive, discussion-based interventions, especially peer-led, are shown to be most effective in increasing knowledge, dispelling myths, and supporting positive attitudes. However, most programs exclude boys or men, and teacher discomfort persists.

Policy and Free Product Initiatives
Increasing numbers of universities and governments (notably in Scotland, some US states, and Canadian provinces) are implementing free menstrual product schemes and establishing menstrual equity initiatives. Effectiveness depends on sustained funding, broad stakeholder buy-in, and inclusion in all campus bathrooms (women's, men's, and gender-neutral), but program evaluations reveal frequent supply gaps and hesitancy in implementation.

Structural and Cultural Recommendations
Studies consistently recommend that institutions provide comprehensive menstrual health policies, ensure private and clean facilities, integrate inclusive education into orientation and wellness programming, and cultivate open, stigma-free campus dialogue by engaging all genders. Normalizing menstruation and providing visible support for menstruators are seen as essential for gender equity in education.

Cross-Cultural and Intersectional Dimensions

Menstrual stigma and silence are global phenomena but manifest differently based on culture, caste, religion, and intersecting identities. Restrictions and taboos remain strong in parts of South Asia and Africa, with unique challenges faced by marginalized groups such as Dalit students in India or low-income girls in rural Africa. Racial and socioeconomic disparities in the US and UK mean that students of color are likelier to experience period poverty and shame. Gender-diverse students are rarely counted in official surveys, highlighting an urgent research gap.

<u>Barriers and Facilitators</u>

Research identifies barriers to open discussion at multiple levels:

- Structural: inadequate / dirty restrooms, lack of proper disposal bins, product shortages
- Cultural/social: taboos, gendered silence, fear of teasing and ridicule, stigma linked to purity/cleanliness
- Institutional: lack of clear, inclusive policies, unsupportive academic staff, no formal mechanisms for accommodations/extensions during periods

Facilitators identified include peer support, access to resources, early and ongoing education (for all genders), encouragement by staff/teachers, visible institutional endorsement, and regular dialogue about menstruation in non-stigmatizing terms.

**<u>Research and Practice Gaps</u>**
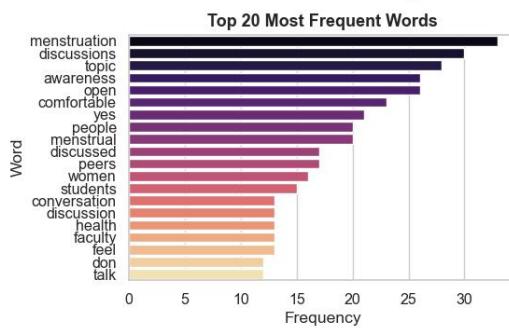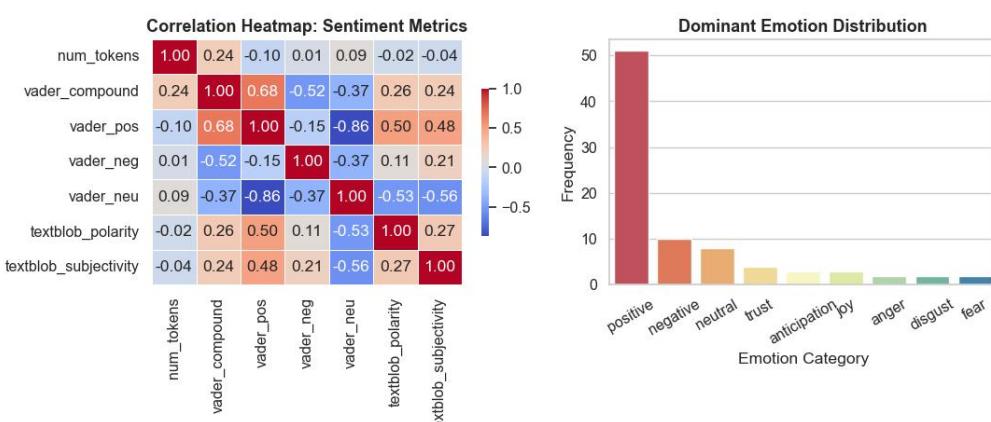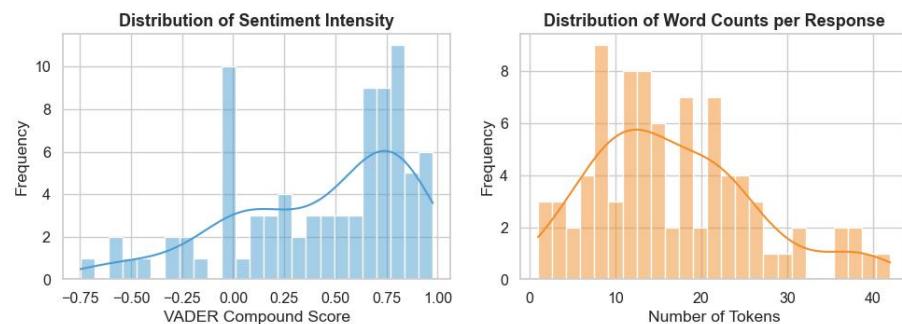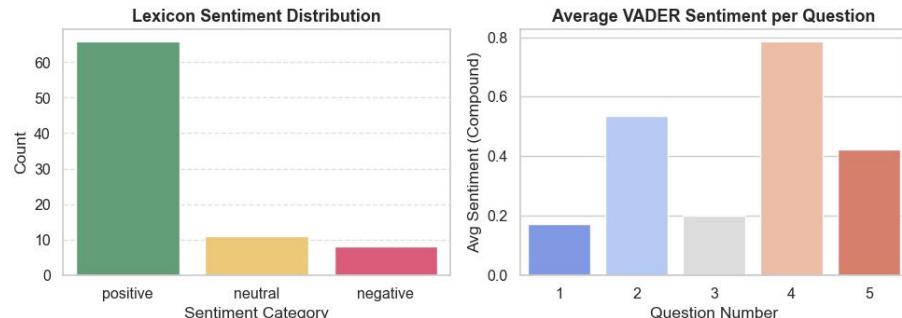
There remain significant research gaps:

- Underrepresentation of gender-diverse and migrant populations
- Limited longitudinal and intervention studies, especially in LMICs
- Insufficient measurement of the impact of policy innovations (free product programs, menstrual leave, accommodations)

FINDINGS AND INTERPRETATIONS

Analysis at a Glance

Overall Text Analysis Dashboard

1. Overall Sentiment Distribution

The **Lexicon Sentiment Distribution** indicates that the majority of responses express **positive sentiment**, with over 60 responses categorized as positive compared to a smaller number of neutral and negative ones. This suggests that most university students hold an optimistic or progressive outlook toward menstrual discussions in academic contexts. While a few respondents still express discomfort or hesitation, the overall emotional tone leans encouragingly toward openness and inclusivity.

2. Average Sentiment per Question

The **Average VADER Sentiment per Question** chart reveals notable differences across the five interview questions.

- **Q4** ("Should universities play a more active role...") shows the **highest average sentiment**, reflecting strong agreement and enthusiasm toward institutional efforts for menstrual awareness and inclusion.

- **Q2** ("Do you personally feel comfortable talking about menstruation...") also registers a moderately positive sentiment, suggesting growing personal comfort, albeit with some lingering hesitation.

- **Q3** ("Reactions or attitudes in mixed-gender/public settings") records a relatively **neutral tone**, implying mixed experiences depending on social context and audience sensitivity.

Overall, responses become more positive when discussing **solutions and institutional responsibility**, indicating that students perceive change as both necessary and achievable.

3. Sentiment Intensity

The **Distribution of Sentiment Intensity** graph (based on VADER compound scores) shows a **right-skewed distribution**, with most responses falling in the range of **0.4 to 1.0**. This confirms that the emotional polarity of the dataset is predominantly positive. However, a small left tail indicates the presence of critical or negative viewpoints, possibly reflecting instances of stigma, embarrassment, or lack of support within academic spaces.

4. Word Count and Expression Depth

The **Distribution of Word Counts per Response** shows that most answers range between **10–25 tokens**, with a gradual decline after 40. This suggests that participants provided **concise yet meaningful** reflections rather than long narratives. The variation in word count also implies differing levels of engagement, some respondents elaborated emotionally, while others preferred brief factual remarks.

5. Correlation of Sentiment Metrics

The **Correlation Heatmap** provides deeper insight into how sentiment measures relate to one another.

- A strong **positive correlation (0.68)** exists between **VADER compound** and **VADER positive scores**, confirming model consistency in identifying positive tone.

- The **negative correlation (-0.86)** between **VADER positive** and **VADER negative** further validates polarity distinction.

- A moderate correlation between **TextBlob polarity** and **VADER compound** (0.27) suggests both lexicons align directionally but differ slightly in magnitude. Overall, this consistency strengthens the reliability of the sentiment analysis results.

6. Emotional Distribution

The **Dominant Emotion Distribution** shows **"positive"** emotions as overwhelmingly dominant, followed by small proportions of **trust**, **neutral**, and **anticipation**. Negative emotions like **anger**, **disgust**, and **fear** appear minimal. This emotional profile reinforces that most participants approach the topic with **constructive and trusting attitudes**, indicating a cultural shift toward openness and empathy in discussing menstruation among university students.

7. Frequent Words and Key Topics

The **Top 20 Most Frequent Words** and **Word Cloud** visualizations collectively highlight recurring ideas and concerns. Commonly used words such as **"menstruation," "discussion," "awareness," "open," "comfortable," "peers,"** and **"students"** emphasize a **dialogue-centered and awareness-oriented** narrative. Terms like *"faculty," "health," "feel,"* and *"talk"* suggest focus on emotional comfort, social interaction, and inclusivity. The presence of *"yes"* as a frequent word reflects affirmation and willingness to engage in conversations about menstruation, further supporting the dominance of positive sentiment observed earlier.

8. Integrated Interpretation

Taken together, the findings indicate that university students are increasingly **comfortable and supportive** of menstruation-related discussions within academic spaces. While social conditioning and gendered discomfort persist in certain situations (especially in mixed groups), the overall discourse is **progressive and empathetic**. Students not only express readiness to normalize menstruation in everyday conversations but also call for **institutional initiatives**, such as awareness drives, open dialogues, and policy interventions, to foster inclusivity. The linguistic and emotional patterns captured through NLP substantiate this evolving cultural openness.

Word Clouds per Question

Word Clouds per Question

These word clouds reflect a strong emphasis on **discussion, awareness, comfort, and inclusion** being central elements of how menstruation is perceived in academic settings.

1. **Question 1:** The most frequent words include **"discussion," "faculty," "students," "open," "topic," "awareness,"** and **"menstruation."** These terms suggest that respondents largely perceive menstrual discussions as **limited but emerging**, with openness varying across peer groups and departments. The repeated appearance of "faculty" implies that participants are conscious of the **faculty's role** , either as facilitators or barriers , in shaping open discourse. Words like "awareness" and "open" indicate gradual normalization, though it is not yet widespread across all academic spaces.
   Interpretation: Students acknowledge some progress in menstrual conversations but still perceive an underlying hesitation, particularly in formal settings involving faculty.

2. **Question 2:** Dominant words such as **"comfortable," "feel," "menstruation," "conversation," "talking," "yes," "peer,"** and **"female"** highlight that personal comfort levels are central to this question. The frequency of "yes" and "comfortable" shows a **positive orientation**, suggesting that many students are open to discussing menstruation with peers, though contextual comfort (e.g., gender of the audience) still

matters. The presence of "professors" and "classroom" indicates that openness is higher in **peer interactions** but lower in **formal academic discussions**.

Interpretation: Comfort largely depends on social context; while peer discussions are often open, formal or mixed-gender environments still pose discomfort for some students.

3. **Question 3:** Key words like **"discussion," "setting," "open," "awkwardness," "people," "reaction," "gender,"** and **"peers"** stand out. The coexistence of "open" and "awkwardness" reflects **mixed perceptions** , while some students find growing acceptance, others continue to sense discomfort and unease, particularly in **mixed-gender contexts**. The frequent use of "awkward" and "reaction" implies social hesitation rooted in cultural taboos.

    Interpretation: Despite a visible shift toward openness, residual **social awkwardness and gendered discomfort** persist when menstruation is discussed publicly or in mixed-gender groups.

4. **Question 4:** Prominent words such as **"awareness," "menstrual," "universities," "active role," "yes," "people," "campus,"** and **"sessions"** convey a strong affirmative sentiment. The repeated occurrence of "yes" reflects clear consensus that institutions should be **actively involved** in promoting menstrual inclusivity through educational initiatives, awareness drives, and supportive infrastructure. Words like "provide," "think," and "definitely" show **proactive expectations** from the student body toward institutional leadership.

    Interpretation: Students overwhelmingly support **institutional involvement**, emphasizing the university's responsibility to normalize menstruation discourse and foster inclusivity through policies and programs.
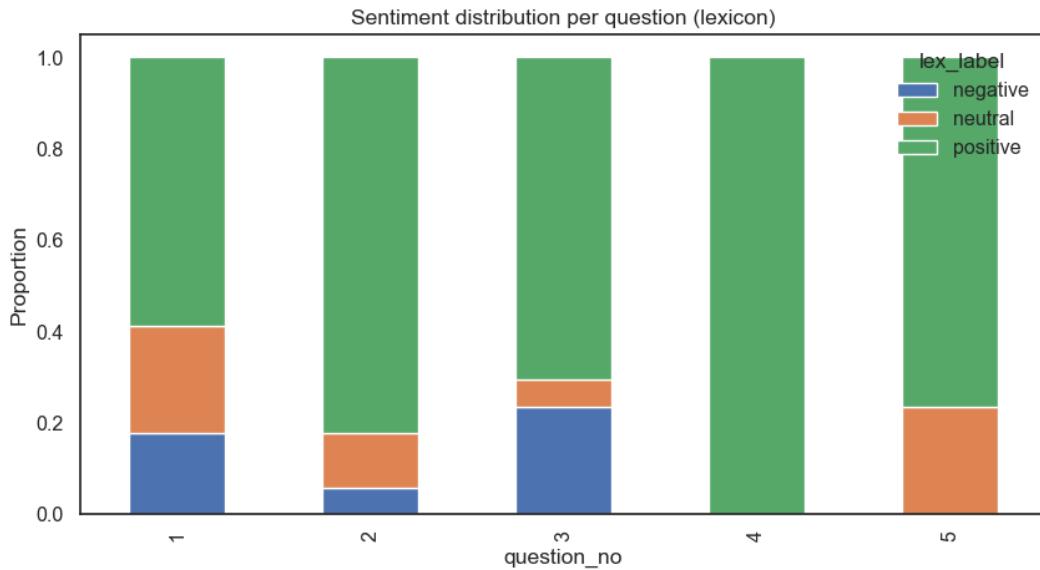
5. **Question 5:** Frequent words include **"discussion," "awareness," "help," "gender," "women," "health," "open," "initiatives,"** and **"posters."** These highlight a constructive mindset focused on **solutions and actionable improvements**. Students suggest **awareness campaigns, workshops, posters, and open discussions** as effective measures to foster inclusivity. The inclusion of words like "help," "initiatives," and "better" reflects optimism and a desire for collaborative change.

    Interpretation: Respondents advocate **practical interventions** such as educational campaigns, improved communication, and visible awareness efforts to create more inclusive and comfortable academic spaces.

Overall, the word clouds depict a **progressive yet transitional narrative**, students are moving toward greater openness, but they also recognize the need for structured support from educational institutions to sustain and normalize these conversations.

Sentiment Analysis

Question-wise Findings and Interpretations

Sentiment distribution per question (lexicon)

Q1: Shows a mix of sentiments though positive responses dominate, there's a noticeable share of negative and neutral tones, indicating **mixed comfort levels** and some **hesitation or stigma** in discussing menstruation.
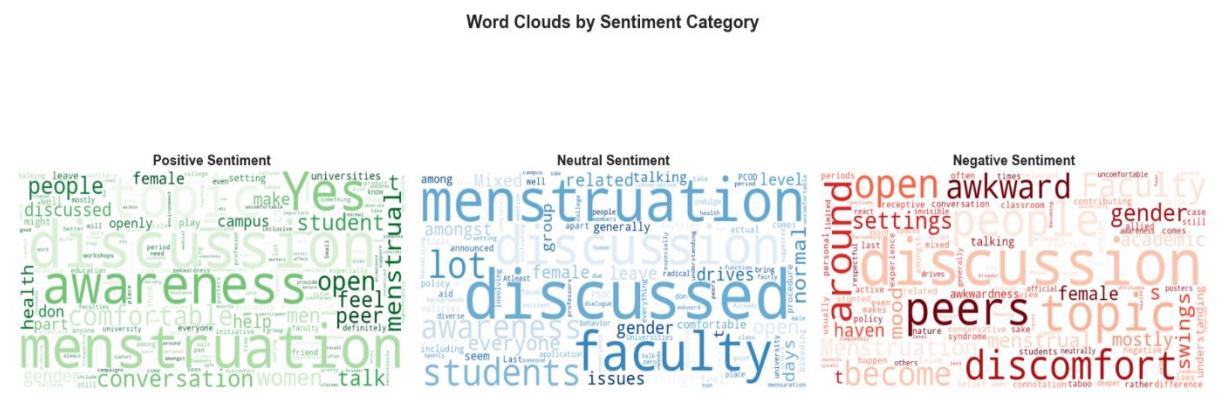
Q2: Mostly positive with minimal negativity, suggesting **greater acceptance** or **understanding** when the question is less sensitive or framed neutrally.

Q3: High positive and moderate negative proportions reflect **awareness but divided opinions**, possibly around institutional or social attitudes.

Q4: Almost entirely positive sentiment, showing **strong agreement or optimism**, likely regarding **faculty support or open discussions** in academic settings.

Q5: Predominantly positive with moderate neutrality suggests **general openness** but also **some indifference**, possibly about **policy or awareness initiatives**.

Word Clouds by Sentiment Category

Word Clouds by Sentiment Category
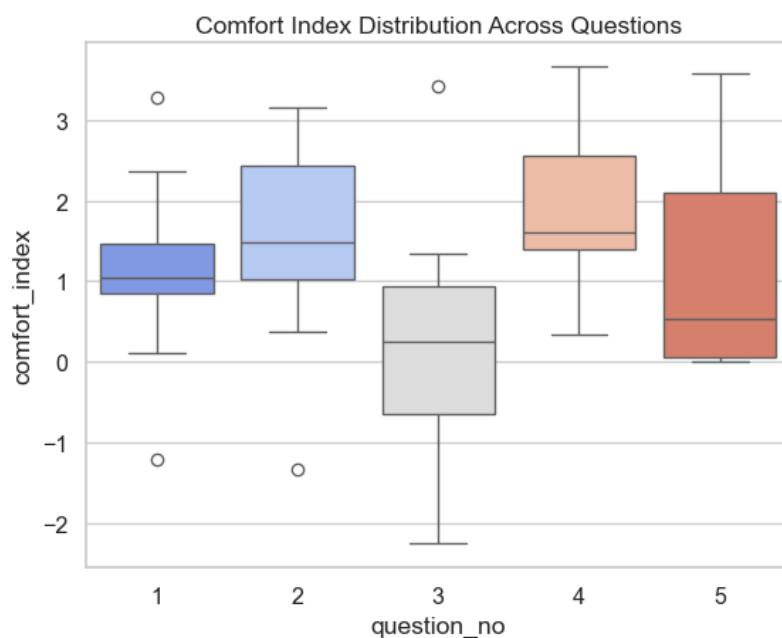
Positive Sentiment: Words like *awareness, menstruation, comfortable, yes, conversation,* and *open* dominate, showing that many respondents' express **comfort, openness, and proactive attitudes** toward menstrual discussions and awareness initiatives.

Neutral Sentiment: Frequent terms such as *discussed, faculty, students,* and *issues* indicate **objective or descriptive responses**, focusing on **institutional or factual aspects** without emotional tone.

Negative Sentiment: Words like *discomfort, awkward, peers, open,* and *discussion* suggest **persistent social unease**, with negativity largely linked to **peer interactions and stigma** surrounding open dialogue on menstruation.

Therefore, while positive sentiment emphasizes **awareness and acceptance**, the negative cluster highlights **social discomfort**, suggesting that although progress is visible, **taboos and hesitation still influence student discussions**.

Comfort Index Across Questions

Comfort Index Distribution Across Questions
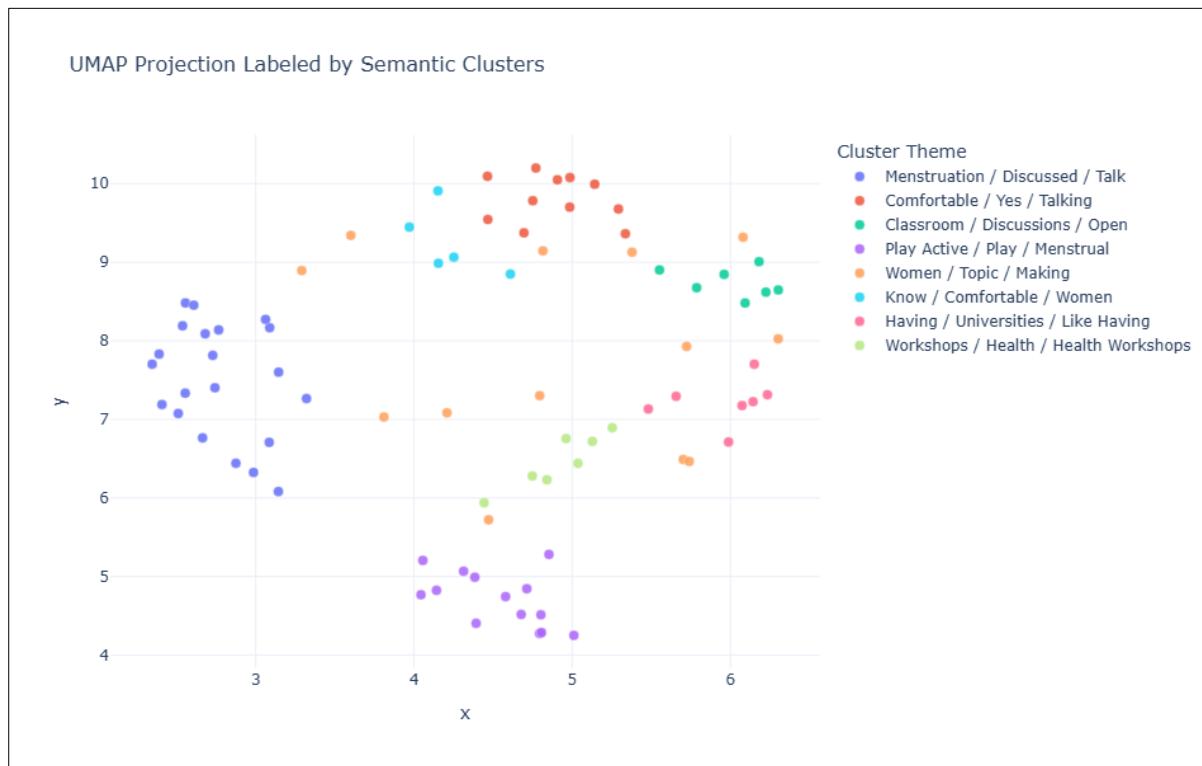
- **Question 2 and 4** show the **highest comfort levels**, with most responses above the median and relatively less variation.
- **Question 3** exhibits the **lowest comfort index**, indicating more discomfort and mixed opinions among respondents.
- **Questions 1 and 5** show **moderate comfort**, with a few outliers suggesting differing comfort perceptions.

Interpretation: Students are generally **more comfortable discussing menstruation** in supportive or structured contexts (as reflected in Q2 and Q4), whereas **peer or mixed-group discussions (Q3)** evoke discomfort and hesitation. Overall, the distribution suggests **context-**

dependent comfort, emphasizing the importance of **safe and inclusive discussion spaces** in academic settings.

Semantic Clustering

UMAP Projection Labeled by Semantic Clusters

Findings:

- The UMAP projection identifies **distinct semantic clusters**, reflecting key discussion themes.
- Prominent clusters include *menstruation and discussion*, *comfort and openness*, and *health workshops and awareness*.
- Related clusters such as *classroom discussions* and *university initiatives* show thematic overlap, suggesting context-specific dialogue patterns.

Interpretation:
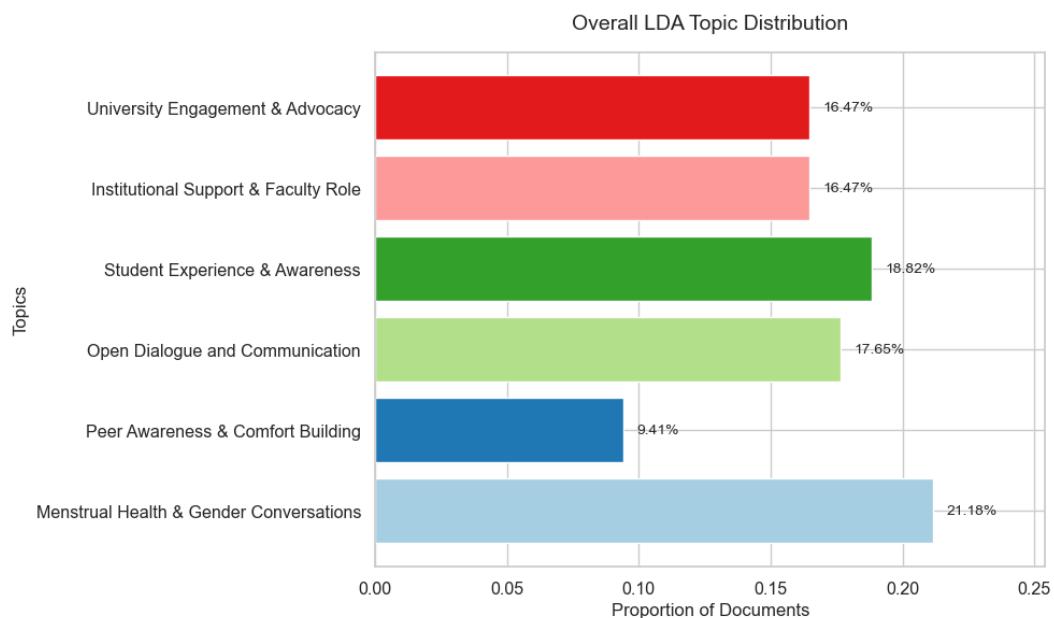
The semantic clustering reveals that conversations around menstruation among university students **centre on openness, awareness, and institutional support**. While some clusters emphasize **comfort and dialogue**, others highlight **health-focused initiatives**, showing that discussions extend beyond stigma reduction to include **educational and wellness dimensions**. This indicates a **multifaceted understanding of menstrual discourse** in academic environments.

Thematic Analysis

Topic Modelling and Assignment with LDA

Topic Index	Topic Name	Keywords
Topic 0	Menstrual Health and Gender Conversations	discussion, topic, health, menstrual, woman, gender, people, setting, notice, menstruation, open, leave
Topic 1	Peer Awareness and Comfort Building	awkwardness, peer, help, topic, awareness, open, talk, friend, change, comfort, create, definitely
Topic 2	Open Dialogue and Communication	talk, peer, discuss, comfortable, topic, openly, conversation, menstruation, feel, female, people, faculty
Topic 3	Student Experience and Awareness	menstruation, talk, discussion, know, student, people, gender, conversation, comfortable, include, awareness, feel
Topic 4	Institutional Support and Faculty Role	discuss, awareness, menstruation, comfortable, lot, discussion, university, open, conversation, female, faculty, feel
Topic 5	University Engagement and Advocacy	open, university, menstrual, play, student, topic, active, awareness, role, discussion, faculty, leave

LDA Topic Distribution


Overall LDA Topic Distribution

Findings:
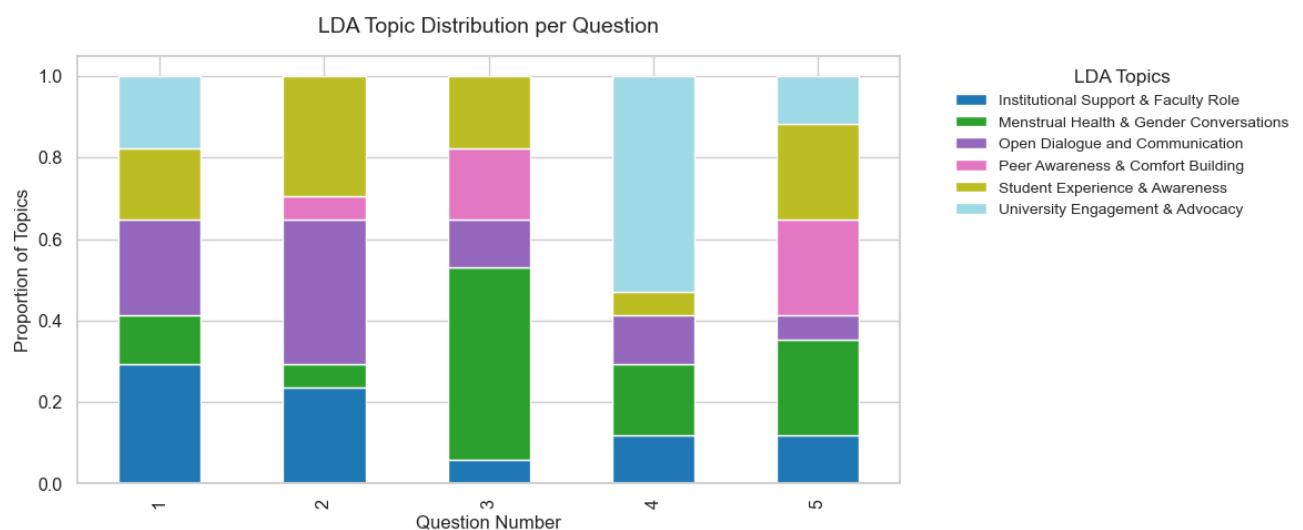
- The most dominant topic is **"Menstrual Health & Gender Conversations" (21.18%)**, highlighting frequent discussion around menstrual awareness and gender sensitivity.

- **"Student Experience & Awareness" (18.82%)** and **"Open Dialogue and Communication" (17.65%)** follow closely, indicating strong emphasis on student perceptions and communication.
- **"University Engagement & Advocacy"** and **"Institutional Support & Faculty Role"** each contribute **16.47%**, showing moderate focus on policy and faculty involvement.
- **"Peer Awareness & Comfort Building" (9.41%)** is the least discussed, suggesting limited peer-level engagement or open comfort on the topic.

Interpretation:

The LDA results suggest that menstruation-related discussions among students are **broadly awareness-driven and institutionally framed**, with significant focus on **health, gender understanding, and communication**. However, the relatively low share of **peer comfort and support** implies that while awareness initiatives exist, **interpersonal openness and normalization remain underdeveloped areas** for future advocacy and intervention.

Question-Wise Topic Distribution

Findings:
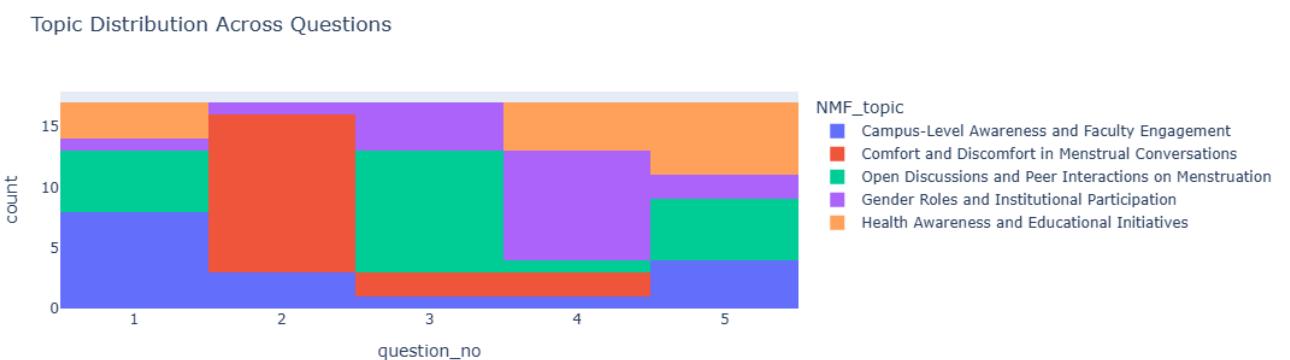
- **Question 1 (Comfort discussing menstruation)** shows a strong mix of *Institutional Support & Faculty Role* and *Open Dialogue and Communication*, indicating that initial responses focused on how openly menstruation is discussed within the campus setting.
- **Question 2 (Barriers to open conversations)** emphasizes *Open Dialogue* and *Student Experience & Awareness*, reflecting personal comfort levels and peer interaction patterns.
- **Question 3 (Peer and faculty responses)** is dominated by *Menstrual Health & Gender Conversations*, showing that perceptions and reactions in mixed-gender settings evoke more health- and gender-related discussions.

- **Question 4 (Institutional support and infrastructure)** centres heavily on *University Engagement & Advocacy*, aligning with participants' views on institutional responsibility and awareness programs.
- **Question 5 (Suggestions for normalization)** highlights *Peer Awareness & Comfort Building* and *Student Experience & Awareness*, focusing on recommendations to make academic spaces more inclusive.

Interpretation: The LDA topic distribution per question indicates a **logical thematic progression** across the interview: from institutional and communication barriers (Q1–Q2), to **social dynamics and gendered perceptions** (Q3), and finally toward **proposed institutional and peer-level reforms** (Q4–Q5). This reflects that while menstruation discourse is evolving, there remains a **need for structured advocacy and community sensitization** to normalize open discussion in academic environments.

NMF Topic Modelling and Visualisation

```
Topic 1:  discussions | open | topic | discussion | peers | settings | classroom | mixed | people | leave

Topic 2:  comfortable | yes | feel | discussing | regardless | conversation | talking | peers | uncomfortable | bit

Topic 3:  health | workshops | awareness | menstrual | help | staff | students | sensitivity | inclusive | definitely

Topic 4:  women | men | universities | play | yes | active | role | people | minded | concerns

Topic 5:  discussed | menstruation | openly | awareness | campus | talk | level | lot | place | faculty
```


Topic Distribution Across Questions

Findings

- The topic **"Campus-Level Awareness and Faculty Engagement"** appears consistently across most questions, showing that institutional involvement is a recurring concern.
- **"Comfort and Discomfort in Menstrual Conversations"** peaks early, reflecting strong sentiments around stigma and hesitation in discussing menstruation openly.
- **"Open Discussions and Peer Interactions on Menstruation"** holds steady across multiple questions, indicating the importance of peer environments in shaping openness.

- **"Gender Roles and Institutional Participation"** becomes more prominent in middle questions, suggesting recognition of structural and cultural barriers.
- **"Health Awareness and Educational Initiatives"** dominates in later responses, showing a shift toward proactive, solution-oriented ideas.

Interpretation: The visualization reveals a **thematic progression from personal experiences of discomfort to collective calls for institutional change and awareness**. Initially, respondents focus on **stigma and social discomfort**, but as the discussion evolves, attention shifts toward **institutional responsibility, education, and policy-driven inclusion**. This indicates growing awareness among students that menstrual discourse should extend beyond personal comfort to become a **shared educational and systemic priority** within university spaces.
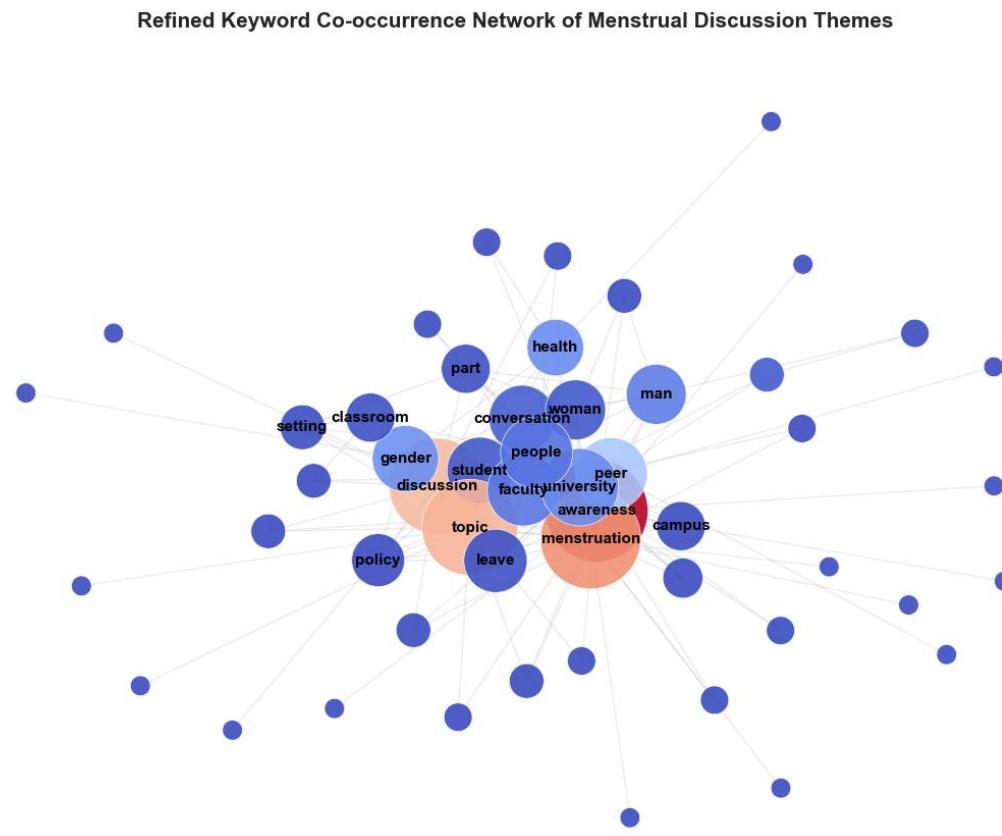
Comparison of LDA and NMF Topic Findings Across Questions

Q.No.	Question Theme	LDA Key Topics (Proportion-based)	NMF Key Topics (Count-based)	Interpretation / Common Insight
Q1	Comfort discussing menstruation in academic spaces	Institutional Support & Faculty Role; Open Dialogue & Communication; Student Experience & Awareness	Campus-Level Awareness & Faculty Engagement; Open Discussions and Peer Interactions on Menstruation	Comfort depends on institutional openness and peer/faculty attitudes , awareness at campus level drives open conversations.
Q2	Barriers to menstrual conversations	Peer Awareness & Comfort Building; Institutional Support & Faculty Role; University Engagement & Advocacy	Comfort and Discomfort in Menstrual Conversations; Gender Roles and Institutional Participation	Students highlight stigma, gendered discomfort, and lack of administrative sensitivity as main conversational barriers.
Q3	Faculty and peer responses to menstrual issues	Open Dialogue & Communication; Student Experience & Awareness	Open Discussions and Peer Interactions on Menstruation; Comfort and Discomfort in	Experiences with peers are supportive but inconsistent; faculty engagement

			Menstrual Conversations	remains limited and gendered.
Q4	Institutional role and support measures	University Engagement & Advocacy; Institutional Support & Faculty Role	Gender Roles and Institutional Participation; Health Awareness and Educational Initiatives	Respondents stress institutional accountability and demand inclusive policies and awareness programs.
Q5	Recommendations for improvement	Menstrual Health & Gender Conversations; Student Experience & Awareness	Health Awareness and Educational Initiatives; Open Discussions and Peer Interactions on Menstruation	Calls for health education, peer sensitization, and normalizing menstruation through workshops and dialogue.

Other Visualisations

Top – 15 Keyword Co-occurrence Network

Refined Keyword Co-occurrence Network of Menstrual Discussion Themes

The visualization depicts how frequently words co-occurred in participant responses, forming interconnected clusters around central discussion themes related to menstruation in academic spaces.

Findings:
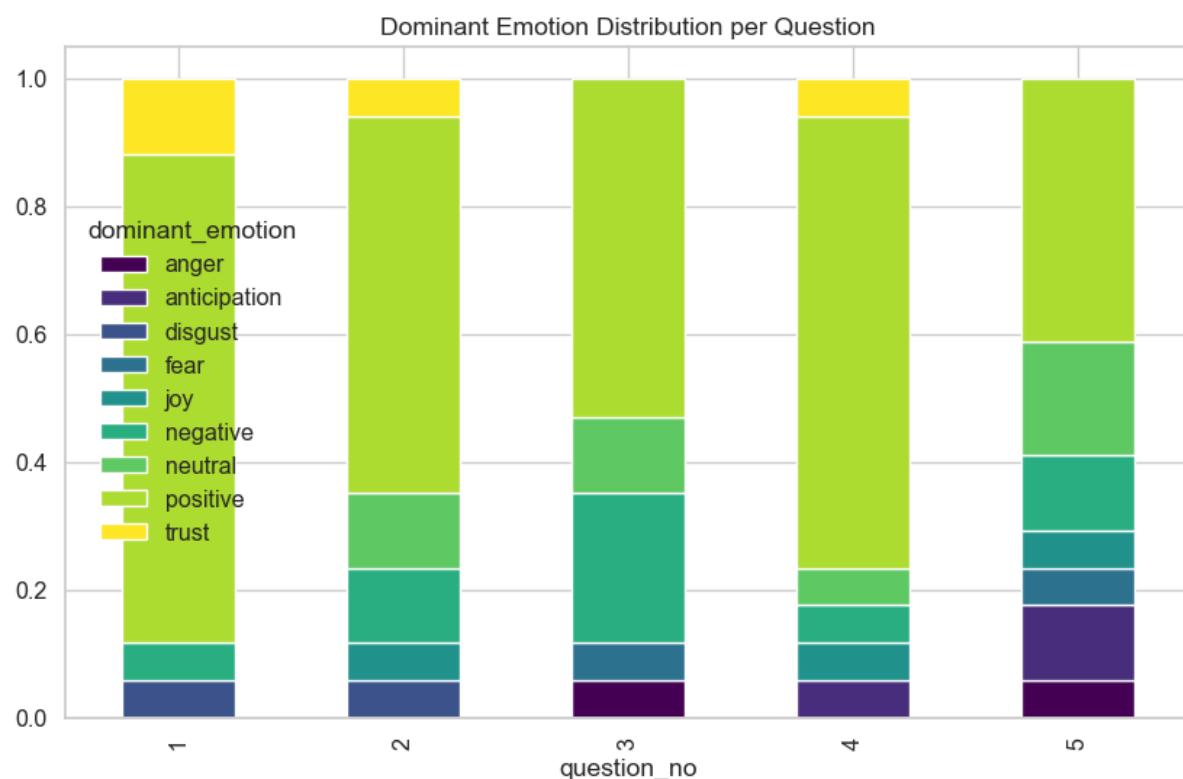
1. **Central Theme – 'Menstruation' and 'Awareness':**
   The largest and most connected nodes are *"menstruation"* and *"awareness"*, showing that conversations predominantly revolve around awareness creation, education, and normalization of menstruation within campus settings.

2. **Institutional and Academic Links:**
   Words like *"university,"* *"faculty,"* *"policy,"* and *"classroom"* are closely linked, highlighting participants' emphasis on the **role of institutions and educators** in facilitating open discussions and supportive policies.

3. **Peer and Gender Dimensions:**
   Co-occurrences with *"peer,"* *"student,"* *"gender,"* *"man,"* and *"woman"* indicate recognition of **peer influence and gendered experiences** in shaping comfort levels and discourse around menstruation.

4. **Health and Support Structures:**
   The presence of *"health," "leave,"* and *"campus"* nodes suggests that **menstrual health management and institutional accommodations** (like leave policies or workshops) are integral to the discussion.

Interpretation: This network reflects an interconnected discourse where **menstrual awareness, institutional participation, gender sensitivity, and peer dialogue** are mutually reinforcing components. It underscores that creating a comfortable environment for menstruation-related discussions requires **both systemic (policy, faculty) and social (peer, awareness) efforts** within the university ecosystem.

Dominant Emotion Distribution with NRCLex

Dominant Emotion Distribution per Question

Findings:

1. **Question 1 (General comfort in discussing menstruation):** Responses were largely *neutral* and *positive*, showing openness yet cautiousness in initial attitudes. A small portion of *trust* suggests growing comfort in acknowledging the topic.

2. **Question 2 (Classroom discussions and institutional openness):** Strong dominance of *neutral* emotion indicates a lack of strong emotional engagement, reflecting that discussions on menstruation in academic contexts remain *formal or limited*.

3. **Question 3 (Role of peers in menstruation-related comfort):** Higher share of *negative* and *fear* emotions appears, suggesting *social discomfort, stigma,* or hesitation when discussing menstruation among peers.

4. **Question 4 (Institutional or faculty initiatives):** A predominantly *neutral* tone suggests respondents view institutional efforts as *adequate but impersonal*, with limited emotional resonance or deep trust yet to be built.

5. **Question 5 (Improvement and awareness suggestions):** While *neutral* and *positive* emotions dominate, there's noticeable *anger* and *anticipation*, reflecting *critical yet hopeful* attitudes, students expect greater efforts toward awareness, inclusivity, and gender sensitivity.

Interpretation: Overall, **neutral and positive emotions** dominate across all questions, suggesting a generally open but still cautious stance toward menstrual discussions. *Negative emotions* emerge in peer-related contexts, reflecting persistent stigma. Meanwhile, *trust and anticipation* highlight optimism for institutional and cultural improvements. The emotional landscape thus reveals a **transitional phase**, students are willing to engage, but structural and social barriers still temper their comfort and enthusiasm.

DISCUSSIONS

Results

The analysis reveals a largely positive and progressive outlook toward menstrual discourse within university environments. Over 60% of responses exhibited positive sentiment, confirming that many students today view menstruation as a legitimate topic for open discussion rather than a taboo subject. The predominance of optimistic language, emphasizing "awareness," "comfort," and "inclusion", reflects a shifting campus culture where gender-sensitive dialogue is increasingly accepted.

Nevertheless, the persistence of negative and neutral sentiments, particularly in mixed-gender and peer-related contexts, highlights that stigma and discomfort have not been fully eradicated. Thematic clustering reinforced these nuances, identifying "Menstrual Health and Gender Conversations" and "Open Dialogue and Communication" as dominant themes, while "Peer Awareness and Comfort Building" remained underrepresented. This indicates that while institutional and policy-level awareness is growing, peer-level normalization of menstruation discussions lags behind.

Emotion analysis further supports this transitional landscape, neutral and positive emotions dominate overall, suggesting cautious openness, while small traces of fear, embarrassment, and anger appear mainly in contexts involving social visibility or mixed audiences. The shift from discomfort in early responses to optimism in later questions signifies a progressive movement from personal hesitancy to collective advocacy for institutional change.

Managerial Recommendations

From a managerial or administrative perspective, universities and higher education institutions can play a transformative role in normalizing menstrual discourse by embedding inclusivity and awareness within their structural and cultural frameworks. Based on the findings, the following actionable recommendations are proposed:

1. **Institutional Awareness Programs:** Organize regular seminars, peer-led workshops, and awareness drives focusing on menstrual health, inclusivity, and gender sensitivity. Such programs should engage all genders to challenge stereotypes and foster empathy.

2. **Inclusive Curriculum Integration:** Introduce menstruation and gender discourse within health education, sociology, or gender studies modules, normalizing the topic as part of academic learning rather than an extracurricular concern.

3. **Faculty Sensitization and Training:** Equip teaching and administrative staff with the tools and language to approach menstrual discussions confidently and respectfully. Faculty play a pivotal role in setting the tone for openness within classrooms.

4. **Infrastructure and Policy Measures:** Ensure clean, accessible restrooms, product availability, and provision of menstrual leave or accommodations. Clear institutional policies reduce stigma and signal administrative support.

5. **Peer Advocacy and Student-Led Campaigns:** Encourage student bodies and clubs to lead awareness initiatives, create safe spaces for discussion, and foster informal dialogue networks. Peer-level normalization is key to long-term cultural change.

These interventions, if implemented systematically, can help bridge the gap between policy-level awareness and everyday comfort among students.

Theoretical Contribution

Theoretically, this study extends the discourse on **gender inclusivity, communication norms, and institutional culture** by employing computational linguistics to quantify qualitative perceptions. It integrates **Natural Language Processing (NLP)** into social research, demonstrating how sentiment analysis and topic modeling can uncover latent emotional and thematic structures within interview data.

Unlike traditional qualitative studies that rely solely on manual coding, this hybrid method enhances objectivity, replicability, and analytical depth. Conceptually, it supports **Feminist Communication Theory** and **Social Learning Theory**, illustrating how open dialogue within educational settings can influence attitude transformation and social norm shifts.

Furthermore, by identifying "Institutional Support & Faculty Role" and "Peer Awareness & Comfort Building" as distinct yet interconnected constructs, the study contributes to the theoretical understanding of how **institutional structures mediate individual comfort** in discussing gendered topics. It underscores that destigmatization is not merely a function of awareness but of **systemic validation and community reinforcement.**

Limitations

While the study offers robust empirical and methodological insights, several limitations merit acknowledgment:

1. **Sample Scope:** The dataset comprises interviews from a limited number of university students, restricting generalizability across broader academic or cultural contexts in India.

2. **Self-Reported Data:** Responses reflect self-perception and may be influenced by social desirability bias, participants could overstate comfort levels in discussing menstruation.

3. **Context Dependence:** The findings may not capture variations across disciplines, regions, or university types (public vs. private), which might influence cultural openness.

4. **Sentiment Lexicon Constraints:** NLP-based sentiment models (VADER, TextBlob, NRCLex) are trained on general-purpose corpora and may not perfectly interpret context-specific nuances or culturally coded emotions related to menstruation.

5. **Temporal Limitation:** The analysis represents a snapshot in time; attitudes toward menstruation evolve, especially as awareness campaigns or social media discourse intensify.

These limitations do not diminish the study's relevance but highlight the complexity of quantifying socio-cultural emotions using computational methods.

<u>Future Research Directions</u>

Future studies can build upon this work in multiple directions:

1. **Longitudinal and Cross-Cultural Studies:** Track changes in attitudes over time and across regions or university types to assess how institutional interventions and societal discourse shape openness.

2. **Inclusion of Gender-Diverse Perspectives:** Incorporate the voices of transgender and non-binary students, who often face distinct barriers and are underrepresented in menstrual discourse research.

3. **Comparative Analysis with Global Contexts:** Extend the framework to universities in other cultural contexts to explore how societal norms and policy environments influence menstrual inclusivity.

4. **Advanced NLP Techniques:** Employ deep learning–based sentiment models (e.g., BERT or RoBERTa) to enhance cultural sensitivity and contextual understanding of emotional language.

5. **Experimental and Intervention-Based Research:** Evaluate the effectiveness of awareness programs, product distribution initiatives, or faculty training workshops through pre- and post-intervention sentiment analysis.

By expanding methodological sophistication and representational diversity, future research can advance both academic theory and institutional practice, reinforcing menstruation as an inclusive, normalized topic of discourse in higher education.

CONCLUSION

This study highlights a promising cultural shift toward openness and inclusivity in menstruation-related conversations within university settings. While stigma and hesitation persist in certain social contexts, particularly in mixed-gender and peer discussions, students largely express positive sentiments and a growing readiness to normalize menstruation as a topic of everyday dialogue. The findings affirm that institutional initiatives, faculty engagement, and peer advocacy play pivotal roles in sustaining this momentum. By combining qualitative insights with computational analysis, the research not only deepens theoretical understanding of gender discourse but also provides practical guidance for universities striving to foster equitable, stigma-free academic environments.

REFERENCES

1. Munro, A.K., Hunter, E.C., Hossain, S.Z., & Keep, M. (2021). A systematic review of the menstrual experiences of university students. *PLoS ONE*, 16(9), e0257333.
https://doi.org/10.1371/journal.pone.0257333

2. Suleman, A., Krishna, S., Krishnakumar, D., Nemoto, K., Nguyễn, M.L.T., & Mehta, S.D. (2024). A pilot survey of students' menstrual attitudes, experiences, and needs on an urban university campus. *Women's Health*, 20, 17455057241254713.
https://doi.org/10.1177/17455057241254713

3. Munro, A.K., Keep, M., Hunter, E.C., & Hossain, S.Z. (2022). Confidence to manage menstruation among university students in Australia. *Women's Health*, 18, 17455065211070666.
https://doi.org/10.1177/17455065211070666

4. Stephenson, R. (2024). The hidden impact of menstruation in higher education. Higher Education Policy Institute (HEPI).

5. Gruer, C., Goss, T., Schmitt, M.L., & Sommer, M. (2021). Menstrual equity initiatives at USA universities: A multiple case study. *Frontiers in Reproductive Health*, 3, 787277.
https://doi.org/10.3389/frph.2021.787277

6. Benshaul-Tolonen, A., et al. (2020). Period teasing, stigma and knowledge: A survey of adolescent boys and girls in Northern Tanzania. *PLoS ONE*, 15(10), e0239914.
https://doi.org/10.1371/journal.pone.0239914

7. Caste, Space, and Menstruation: Exploring Intersectional Barriers. (2025). *Taylor & Francis Online*.
Systematic review of educational interventions to improve menstrual health knowledge. (2022). *BMJ Open*.
https://doi.org/10.1136/bmjopen-2021-057204

8. Engaging boys in menstrual hygiene management (MHM) education. *IWA Online*.
Attitude and socio-cultural practices during menstruation in female college students. Menstrual Equity Pilot Project at UC Berkeley. (2020). *UC Berkeley Facilities Services*.
https://facilities.berkeley.edu/menstrual-equity-pilot-project