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Social Media Algorithm Recommendations and Social Connection Among Digital Natives: The Moderating Role of Information Cocoon

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ABSTRACT

This study explores the relationship between social media algorithm recommendation types (personalized interest vs. diverse social recommendations) and digital natives' (18–25 years old) social connections (emotional vs. behavioral), as well as the moderating role of information cocoons. Adopting a mixed-methods design, it conducted a cross-sectional survey (N=2,156) and semi-structured interviews (N=45) with participants from five countries (China, Germany, India, Spain, Ghana). Survey results showed diverse social recommendations positively predicted both emotional and behavioral connections, while personalized interest recommendations had a non-significant positive effect on emotional connection and a weak positive effect on behavioral connection. Information cocoons significantly moderated the link between diverse social recommendations and social connections (weakening the positive association), but their negative moderating effect on personalized interest recommendations was insignificant. Interview findings further indicated diverse recommendations boosted cross-group interactions, whereas personalized ones narrowed information horizons; active information-seeking could mitigate information cocoons' negative impacts. These findings deepen theoretical insights into algorithmic media's effects on social development and guide rational algorithm use.

Keywords: Digital natives; Social media algorithm; Algorithm recommendation type; Social connection; Information cocoon; Moderating effect; Mixed-methods research

1. Introduction

As the core group growing up in the algorithm-driven digital era, digital natives (born after 1995) are accustomed to obtaining information and conducting social interactions through social media platforms equipped with algorithm recommendation systems (Van Dijck et al., 2023; boyd, 2022). Unlike traditional manual information push, algorithm recommendation systems analyze users' historical behavior data (such as browsing records, likes, and comments) to generate personalized content streams, which greatly improves the efficiency of information acquisition for digital natives (Bozdag, 2022). However, the popularization of algorithm recommendation has also triggered widespread academic debates: on the one hand, it is believed that algorithm recommendation can break through geographical and group restrictions, help digital natives contact diverse social groups, and enhance social connection (Hampton et al., 2023); on the other hand, there are concerns that excessive personalized recommendation will trap digital natives in an „information cocoon" (Pariser, 2011), reducing their exposure to heterogeneous information and social groups, thereby weakening social connection and even causing social division (Sun et al., 2024).

Social connection, defined as the emotional and behavioral ties formed between individuals through social interaction (Baumeister & Leary, 2022), is a key factor affecting digital natives' psychological well-being and social integration. Existing studies on the relationship between social media algorithm recommendation and social connection have shown inconsistent conclusions. Some studies have found that personalized algorithm recommendation can enhance users' sense of identity and belonging by pushing content that matches their interests, thereby strengthening social connection with like-minded groups (Chen & Lee, 2023). However, other studies have pointed out that algorithm-driven information cocoon will reduce users' opportunities for cross-group interaction, limit the expansion of social networks, and thus weaken overall social connection (Qiu et al.,

2023). This inconsistency may stem from the failure to distinguish between different types of algorithm recommendations and different dimensions of social connection, and the lack of in-depth exploration of the moderating role of information cocoon.

Information cocoon, characterized by users' long-term exposure to homogeneous information and limited contact with heterogeneous perspectives (Pariser, 2011; Wang et al., 2022), is an important intermediary variable in the process of algorithm recommendation affecting social connection. Digital natives with a high degree of information cocoon may rely more on algorithm recommendations to obtain information, and their social interaction scope is easily restricted to existing social circles, making it difficult to form new social connections. In contrast, digital natives with a low degree of information cocoon may actively seek diverse information and social resources beyond algorithm recommendations, thereby weakening the negative impact of personalized recommendation on social connection (Zhang & Wang, 2024). However, few studies have systematically examined the moderating effect of information cocoon in the relationship between algorithm recommendation types and social connection, and the underlying mechanism remains unclear.

Furthermore, most existing studies on algorithm recommendation and social connection are based on single-country samples, ignoring cross-cultural differences (Hampton et al., 2023; Van Dijck et al., 2023). Digital natives from different cultural contexts (e.g., collectivistic vs. individualistic cultures) may have different usage habits of social media algorithms and perceptions of social connection. For example, in collectivistic cultures that emphasize group harmony and interpersonal interdependence, digital natives may be more inclined to accept diverse social recommendations to maintain social ties with different groups; in individualistic cultures, they may prefer personalized interest recommendations to meet individual needs, which may lead to differences in the relationship between algorithm recommendation and social connection (Barry et al., 2023). Therefore,

cross-cultural research is needed to enhance the generalizability of the findings.

To address these gaps, this study adopts a mixed-methods and cross-cultural approach to investigate the relationship between different types of social media algorithm recommendations (personalized interest recommendation vs. diverse social recommendation) and different dimensions of digital natives' social connection (emotional connection vs. behavioral connection), and explores the moderating role of information cocoon. The study aims to: (1) Examine the differential effects of personalized interest recommendation and diverse social recommendation on digital natives' emotional and behavioral social connection; (2) Test the moderating role of information cocoon in the above relationships; (3) Explore digital natives' subjective experiences and coping strategies regarding algorithm recommendation, information cocoon, and social connection through interviews; (4) Investigate potential cross-cultural variations in the relationship between algorithm recommendation types, information cocoon, and social connection.

This study contributes to media psychology and algorithmic culture research by clarifying the complex relationship between social media algorithm recommendation and digital natives' social connection, identifying information cocoon as a key moderating mechanism, and enhancing the generalizability of findings through a cross-cultural mixed-methods design. Practically, the study provides actionable insights for guiding digital natives to use social media algorithm functions rationally, alleviating the negative impact of information cocoon, and promoting healthy social connection.

The structure of this paper is as follows: Section 2 reviews relevant literature and develops research hypotheses; Section 3 details the research methodology, including survey participants, measures, interview protocol, data collection procedures, and data analysis strategies; Section 4 presents the study results from both the survey and interviews; Section 5 discusses the main findings, their theoretical and practical implications, study limitations, and future research directions; Section 6 concludes with a summary of key contributions.

2. Literature Review and Hypotheses

2.1 Social Media Algorithm Recommendation Types: Personalized Interest vs. Diverse Social

Based on the content and purpose of recommendation, social media algorithm recommendations can be divided into two types: personalized interest recommendation and diverse social recommendation (Bozdag, 2022; Sun et al., 2024). Personalized interest recommendation focuses on matching users' individual interests, and its core logic is to analyze users' historical behavior data to push content that is highly consistent with their preferences (e.g., pushing posts about photography to users who frequently browse photography content, or recommending friends with the same hobbies) (Chen & Lee, 2023). This type of recommendation aims to improve user stickiness by meeting individual needs.

Diverse social recommendation focuses on expanding users' social horizons, and its core logic is to actively push content and social resources beyond users' existing interest circles, including heterogeneous information, cross-group contacts, and social activities of different groups (e.g., pushing posts about environmental protection to users who only browse entertainment content, or recommending friends from different cultural backgrounds) (Hampton et al., 2023; Zhang & Wang, 2024). This type of recommendation aims to promote user exposure to diverse perspectives and social groups, thereby facilitating social integration.

2.2 Social Connection Among Digital Natives: Emotional vs. Behavioral

Drawing on the conceptualization of social connection in social psychology, this study divides digital natives' social connection into two dimensions: emotional connection and behavioral connection (Baumeister & Leary, 2022; Qiu et al., 2023). Emotional connection refers to the emotional ties and

sense of belonging formed between individuals through social interaction, including feelings of trust, intimacy, and mutual understanding (e.g., feeling emotionally attached to friends met through social media, or having a sense of belonging to a social group) (Wang et al., 2022).

Behavioral connection refers to the specific social interaction behaviors and behavioral ties formed between individuals, including online interaction frequency, offline meeting frequency, and mutual help behaviors (e.g., frequently chatting with friends recommended by algorithms online, or participating in offline activities organized by cross-group contacts) (Hampton et al., 2023). For digital natives, both emotional and behavioral social connection are crucial for their psychological health and social development: emotional connection provides emotional support and a sense of security, while behavioral connection promotes the accumulation of social resources and social integration.

2.3 Algorithm Recommendation Types and Social Connection

We hypothesize that personalized interest recommendation and diverse social recommendation have differential effects on digital natives' emotional and behavioral social connection.

For personalized interest recommendation: By pushing content and social resources that match users' interests, it can help digital natives quickly find like-minded groups, enhance the sense of identity and intimacy with these groups, and thus positively affect emotional connection (Chen & Lee, 2023). However, personalized interest recommendation is limited to users' existing interest circles, which is not conducive to expanding social networks. Although it can strengthen the behavioral interaction with existing like-minded groups, its promotion effect on overall behavioral connection (especially cross-group behavioral interaction) is weak (Qiu et al., 2023). Thus:

H1a: Personalized interest recommendation is positively associated with emotional connection among digital natives.

H1b: Personalized interest recommendation has a weak positive association with behavioral connection among digital natives.

For diverse social recommendation: By pushing heterogeneous information and cross-group social resources, it can help digital natives break through the limitations of existing social circles, contact diverse social groups, and thus expand behavioral interaction scope, positively affecting behavioral connection (Hampton et al., 2023; Zhang & Wang, 2024). At the same time, exposure to diverse perspectives and social experiences can enhance digital natives' understanding and tolerance of different groups, which is conducive to forming emotional ties with diverse groups and thus positively affecting emotional connection. Thus:

H2a: Diverse social recommendation is positively associated with emotional connection among digital natives.

H2b: Diverse social recommendation is positively associated with behavioral connection among digital natives.

2.4 The Moderating Role of Information Cocoon

Information cocoon is a state in which users are trapped in homogeneous information environments due to personalized algorithm recommendations and active selection behaviors (Pariser, 2011; Wang et al., 2022). We hypothesize that information cocoon moderates the relationship between algorithm recommendation types and digital natives' social connection.

For diverse social recommendation: Digital natives with a high degree of information cocoon are accustomed to homogeneous information and existing social circles, and may have resistance to diverse social resources pushed by algorithms, reducing their willingness to interact with cross-group contacts. Thus, the positive effect of diverse social recommendation on social connection (emotional and behavioral) will be weakened. In contrast, digital natives with a low degree of information cocoon are more willing to accept diverse information and social resources, and can better utilize diverse social recommendations to expand social

connection. Thus:

H3a: Information cocoon moderates the positive relationship between diverse social recommendation and emotional connection—this relationship is weaker for individuals with high information cocoon.

H3b: Information cocoon moderates the positive relationship between diverse social recommendation and behavioral connection—this relationship is weaker for individuals with high information cocoon.

For personalized interest recommendation: Digital natives with a high degree of information cocoon will further deepen their dependence on homogeneous information and like-minded groups under the influence of personalized interest recommendation, which may strengthen the emotional connection with existing groups but not help expand behavioral connection. However, due to the limited scope of social circles, the overall promotion effect on social connection is still weak. For digital natives with a low degree of information cocoon, personalized interest recommendation can only meet their specific interest needs, and they will actively seek other social resources beyond the algorithm recommendation, so the positive effect of personalized interest recommendation on social connection is not significantly enhanced. Thus, information cocoon has no significant moderating effect on the relationship between personalized interest recommendation and social connection:

H4a: Information cocoon has no significant moderating effect on the positive relationship between personalized interest recommendation and emotional connection.

H4b: Information cocoon has no significant moderating effect on the weak positive relationship between personalized interest recommendation and behavioral connection.

3. Method

3.1 Research Design

A mixed-methods research design, combining a cross-sectional survey and semi-structured interviews, was employed in this study. The survey was used to test the research hypotheses (quantitative phase), while the semi-structured interviews were conducted to explore digital natives' subjective experiences, perceptions, and coping strategies regarding algorithm recommendation, information cocoon, and social connection (qualitative phase). This mixed-methods approach allows for triangulation of findings, enhancing the validity and depth of the research (Creswell & Clark, 2017; Tashakkori & Teddlie, 2020).

3.2 Survey Participants

A cross-sectional survey was conducted with digital natives aged 18–25 years from five countries: China, Germany, India, Spain, and Ghana. The sample size was determined based on power analysis for moderated regression models (Hair et al., 2022), which recommended a minimum sample size of 2,000 to detect small-to-medium effect sizes ($f^2 = 0.05$) with 95% power and $\alpha = 0.05$. A total of 2,380 questionnaires were distributed, and 2,156 valid questionnaires were retained after excluding invalid responses (e.g., incomplete responses [<80% completion], systematic response patterns, inconsistent answers to attention check items). The effective response rate was 90.6%.

Demographic characteristics of the survey sample were as follows: 1,128 females (52.3%) and 1,028 males (47.7%); age range 18–25 years, with a mean age of 21.63 years (SD = 2.12). By country, the sample included 432 participants from China (20.0%), 430 from Germany (20.0%), 429 from India (19.9%), 433 from Spain (20.1%), and 432 from Ghana (20.0%). The most commonly used social media platforms were WeChat/Weibo (28.7%), Instagram (32.1%), Facebook (18.2%), WhatsApp (12.5%), and regional platforms (8.5%). The average daily social media use time was 3.22 hours (SD = 1.41), with 50.3% of participants reporting using social media for 3 or more hours per day. The primary motivations for social media use were information seeking (72.4%), social interaction (69.8%), and entertainment (63.1%).

3.3 Survey Measures

All survey measures were adapted from previously validated scales in algorithmic media and social connection research. To ensure cross-cultural validity, the scales were translated into the local languages of each country (Mandarin, German, Hindi, Spanish, Twi) using the back-translation method (Brislin, 1980; Van de Vijver & Leung, 2022). A team of bilingual researchers (fluent in English and the target language) translated the scales from English to the target language, and a separate team back-translated them to English. Discrepancies were resolved through consensus. A pilot study was conducted with 150 participants (30 per country) to assess the clarity and psychometric properties of the translated scales, with minor revisions made to improve item clarity. All scales used a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), and Cronbach's α coefficients for all scales exceeded 0.70, indicating acceptable internal consistency (Nunnally & Bernstein, 1994).

3.3.1 Social Media Algorithm Recommendation Types

Algorithm recommendation types were measured using an adapted version of the Algorithm Recommendation Scale (Chen & Lee, 2023; Sun et al., 2024), which assesses personalized interest recommendation and diverse social recommendation. Personalized interest recommendation (7 items) measures the frequency and degree of receiving interest-matched recommendations. Sample items: „The social media content recommended to me is highly consistent with my hobbies"; „Social media often recommends friends with the same interests to me"; „The recommended content on my social media homepage is mostly what I am interested in". Cronbach's α = 0.86.

Diverse social recommendation (7 items) measures the frequency and degree of receiving cross-interest and cross-group recommendations. Sample items: „Social media often recommends content about different cultures or groups to me"; „I often receive recommendations for friends from different backgrounds on social media"; „The recommended content on my social media homepage helps me understand perspectives different from my own". Cronbach's α = 0.87.

3.3.2 Social Connection

Social connection was measured using an adapted version of the Social Connection Scale (Baumeister & Leary, 2022; Qiu et al., 2023), which assesses emotional connection and behavioral connection. Emotional connection (6 items) measures the emotional ties with social contacts met or maintained through social media. Sample items: „I feel emotionally close to friends I met through social media algorithm recommendations"; „I have a strong sense of belonging to social groups I joined due to algorithm recommendations"; „I trust the people who interact with me through algorithm-recommended content". Cronbach's α = 0.84.

Behavioral connection (6 items) measures the social interaction behaviors with social contacts met or maintained through social media. Sample items: „I often chat online with friends recommended by social media algorithms"; „I have participated in offline activities organized by groups recommended by algorithms"; „I often help or receive help from people I know through algorithm-recommended content". Cronbach's α = 0.85.

3.3.3 Information Cocoon

Information cocoon was measured using an adapted version of the Information Cocoon Scale (Pariser, 2011; Wang et al., 2022). The scale includes 6 items that assess the degree of exposure to homogeneous information and the limitation of social horizons. Sample items: „Most of the information I get from social media is consistent with my existing views"; „My social media contacts are mostly people with the same interests and perspectives"; „I rarely come into contact with information that challenges my own views through social media". Cronbach's α = 0.83.

3.3.4 Covariates

Based on previous research (Hampton et al., 2023; Chen & Lee, 2023), the following covariates were included in the analyses: gender (1 = female, 0 = male), age (continuous), daily social media use

time (1 = <1 hour, 2 = 1–2 hours, 3 = 2–3 hours, 4 = ≥3 hours), primary motivation for social media use (1 = information seeking, 2 = social interaction, 3 = entertainment, 4 = creative expression), and country (dummy-coded with China as the reference group). These variables were controlled for to isolate the unique effects of algorithm recommendation types and information cocoon on social connection.

3.4 Interview Protocol

Semi-structured interviews were conducted to explore digital natives' subjective experiences and coping strategies regarding algorithm recommendation, information cocoon, and social connection. A purposive sampling strategy was used to select interview participants who represented different genders, ages, and countries (9 participants per country, totaling 45 participants). The interview protocol included four main sections: (1) Experiences of social media algorithm recommendation (e.g., „What types of algorithm recommendations do you usually receive on social media? How do you feel about them?"); (2) Perceptions of the relationship between algorithm recommendation and social connection (e.g., „How do you think algorithm recommendations on social media affect your relationships with others?"); (3) The role of information cocoon in algorithm use and social connection (e.g., „Have you ever felt that you are only exposed to certain types of information on social media? How does this affect your social interaction?"); (4) Coping strategies for algorithm recommendation and information cocoon (e.g., „Do you have any strategies to avoid being trapped in narrow information or social circles on social media? If yes, what strategies do you use?"). Each interview lasted 30–45 minutes and was audio-recorded with participants' consent.

3.5 Data Collection Procedures

The study was approved by the Institutional Review Boards (IRBs) of all participating universities (Tsinghua University IRB#: 2024-0345; University of Hamburg IRB#: 2024-0512; University of Delhi IRB#: DU/IRB/2024-067; Autonomous University of Madrid

IRB#: 2024-0298; University of Cape Coast IRB#: UCC/IRB/2024-045). Prior to data collection, informed consent was obtained from all survey and interview participants.

Survey data were collected online via Qualtrics between January 2024 and May 2024. Participants were recruited through school-based recruitment (universities and colleges), community youth centers, and online social media groups to ensure sample diversity. No incentives were provided to avoid potential response biases. Interview data were collected face-to-face or via video conferencing (for participants in remote areas) during the same period. After each interview, the audio recordings were transcribed verbatim, and the transcripts were reviewed and verified by two researchers to ensure accuracy.

3.6 Data Analysis Strategies

3.6.1 Quantitative Data Analysis

Quantitative data analysis was conducted using SPSS 28.0 and PROCESS macro (Hayes, 2017). The following analytical steps were implemented: (1) Descriptive statistics: Means, standard deviations, and frequencies were calculated for all variables to describe the sample characteristics and variable distributions. Normality was assessed using Shapiro-Wilk tests and visual inspection of histograms; no significant deviations from normality were observed. (2) Correlation analysis: Pearson correlation coefficients were computed to examine bivariate relationships between variables, identifying potential multicollinearity. (3) Hypothesis testing for direct effects: Hierarchical multiple regression analyses were conducted to test the direct effects of algorithm recommendation types on social connection dimensions, controlling for covariates. (4) Moderation analysis: The PROCESS macro (Model 1) was used to test the moderating role of information cocoon, with 5,000 bootstrap samples to assess the significance of the interaction effects. (5) Cross-cultural analysis: Multigroup regression analyses were conducted to explore potential cross-cultural variations, with interaction terms between country and algorithm

recommendation types added to the regression models.

3.6.2 Qualitative Data Analysis

Qualitative data analysis was conducted using thematic analysis (Braun & Clarke, 2022). The following steps were implemented: (1) Familiarization: Researchers read and re-read the interview transcripts to become familiar with the data. (2) Coding: Initial codes were generated by coding the transcripts line by line. (3) Theme development: Codes were grouped into potential themes based on their similarities and relationships. (4) Theme refinement: Themes were reviewed and refined to ensure they were distinct, coherent, and representative of the data. (5) Reporting: Themes were described and interpreted, with illustrative quotes from participants included to support the findings. Two researchers independently coded the data, and discrepancies were resolved through discussion and consensus to ensure inter-coder reliability (Cohen's kappa = 0.88, indicating good reliability).

4. Results

4.1 Quantitative Results

4.1.1 Descriptive Statistics and Correlation Analysis

Descriptive statistics for the main variables are presented below: Personalized interest recommendation (M = 3.72, SD = 0.85), diverse social recommendation (M = 3.18, SD = 0.92), emotional connection (M = 3.46, SD = 0.87), behavioral connection (M = 3.35, SD = 0.89), information cocoon (M = 3.25, SD = 0.84).

Correlation analyses revealed the following key relationships (all $p < 0.001$ unless otherwise noted): Personalized interest recommendation was significantly positively correlated with emotional connection (r = 0.23) and weakly positively correlated with behavioral connection (r = 0.11, $p < 0.01$). Diverse social recommendation was significantly positively correlated with emotional connection (r = 0.45) and behavioral connection (r = 0.42). Information cocoon was significantly negatively correlated with diverse social recommendation (r = -0.38), emotional connection (r = -0.32), and behavioral connection (r = -0.35), and not significantly correlated with personalized interest recommendation (r = 0.06, $p > 0.05$). No significant multicollinearity was detected, as all variance inflation factors (VIF) were below 2.3 (Hair et al., 2022).

4.1.2 Direct Effects of Algorithm Recommendation Types on Social Connection

Hierarchical multiple regression analyses (controlling for covariates) confirmed the direct effects of algorithm recommendation types on social connection:

For emotional connection: Step 1 (covariates) explained 9% of the variance (F = 20.15, $p < 0.001$). Step 2 (adding algorithm recommendation types) explained an additional 21% of the variance ($\Delta F = 289.36$, $p < 0.001$). Personalized interest recommendation had a significant positive effect ($\beta = 0.15$, $p < 0.001$), confirming H1a. Diverse social recommendation had a significant positive effect ($\beta = 0.40$, $p < 0.001$), confirming H2a.

For behavioral connection: Step 1 (covariates) explained 8% of the variance (F = 18.67, $p < 0.001$). Step 2 (adding algorithm recommendation types) explained an additional 18% of the variance ($\Delta F = 245.78$, $p < 0.001$). Personalized interest recommendation had a weak significant positive effect ($\beta = 0.08$, $p < 0.01$), confirming H1b. Diverse social recommendation had a significant positive effect ($\beta = 0.37$, $p < 0.001$), confirming H2b.

4.1.3 Moderating Role of Information Cocoon

Moderation analysis using the PROCESS macro (Model 1) revealed the moderating role of information cocoon:

For the relationship between diverse social recommendation and emotional connection: The interaction term between diverse social recommendation and information cocoon was significant ($\beta = -0.13$, $p < 0.001$), indicating that information cocoon weakens the positive relationship. Simple slope analysis showed that the positive effect of diverse social recommendation on emotional connection was stronger for individuals with low

information cocoon (β = 0.53, p < 0.001) than for those with high information cocoon (β = 0.27, p < 0.001), confirming H3a.

For the relationship between diverse social recommendation and behavioral connection: The interaction term between diverse social recommendation and information cocoon was significant (β = -0.12, p < 0.001), with a stronger positive effect for individuals with low information cocoon (β = 0.49, p < 0.001) than for those with high information cocoon (β = 0.25, p < 0.001), confirming H3b.

For the relationship between personalized interest recommendation and emotional connection: The interaction term between personalized interest recommendation and information cocoon was non-significant (β = 0.02, p > 0.05), confirming H4a.

For the relationship between personalized interest recommendation and behavioral connection: The interaction term between personalized interest recommendation and information cocoon was non-significant (β = 0.03, p > 0.05), confirming H4b.

4.1.4 Cross-Cultural Analysis

Multigroup regression analyses revealed minimal cross-cultural variations. The direct and moderating effects were generally consistent across the five countries. The only minor variation was in the strength of the relationship between diverse social recommendation and behavioral connection, which was stronger in collectivistic cultures (China, India, Ghana) (β = 0.40–0.42) than in individualistic cultures (Germany, Spain) (β = 0.33–0.35). However, the interaction terms between country and algorithm recommendation types were not statistically significant (all p > 0.05), suggesting that the patterns of relationships are generally universal across the five cultural contexts.

4.2 Qualitative Results

Thematic analysis of the interview data identified four main themes related to algorithm recommendation, information cocoon, and social connection among digital natives:

4.2.1 Diverse Social Recommendation: A Catalyst for Cross-Group Social Connection

Most interview participants reported that diverse social recommendation helped them expand their social horizons and form new social connections. They obtained information about different cultures, groups, and activities through diverse recommendations, and further established contact with cross-group individuals. As one participant from China noted: „I usually like to browse content about literature, but social media sometimes recommends posts about environmental protection volunteer activities. I joined the volunteer group through these posts and met many friends with different professional backgrounds. We often participate in offline activities together, which makes my social circle much wider." A participant from India stated: „Facebook often recommends groups about cross-cultural communication to me. By participating in group discussions, I have made friends from Pakistan and Bangladesh. We share our cultural customs with each other, and this kind of cross-border friendship makes me feel very meaningful."

4.2.2 Personalized Interest Recommendation: Strengthening Existing Social Circles but Limiting Expansion

Participants reported that personalized interest recommendation strengthened their connection with like-minded groups but was not conducive to expanding social networks. They felt a strong sense of identity and intimacy with groups that matched their interests, but their social interaction scope was limited. A participant from Germany said: „Instagram always recommends content about street photography to me, which is exactly my hobby. I have made many photography friends through these recommendations, and we often share shooting skills. But I found that my social circle is almost all photographers, and I rarely come into contact with people from other fields." A participant from Spain noted: „The friends recommended to me by social media are all people who like football, which makes it easier for us to chat. But sometimes I feel that my social circle is too narrow, and I want to meet

people with different hobbies but don't know how to do it."

4.2.3 Information Cocoon: A Barrier to Diverse Social Connection

Participants with a high degree of information cocoon reported that they were trapped in narrow information and social circles, which hindered their diverse social connection. They were accustomed to receiving homogeneous information and had resistance to heterogeneous content and cross-group contacts. A participant from Ghana said: „I only browse content about local politics on social media, and the platform also keeps pushing similar content to me. I rarely see information about other regions or cultures, and my friends are all people who have the same views on politics as me. Once I tried to talk to someone with different political views, but we couldn't communicate at all." A participant from China stated: „I used to only pay attention to celebrities I like, and the recommended content was all about them. I didn't care about other things at all. Later, I found that I couldn't talk to my classmates about other topics, and my social life became very monotonous."

4.2.4 Coping Strategies for Alleviating Information Cocoon and Promoting Social Connection

Participants reported various strategies to alleviate information cocoon and promote diverse social connection. Most participants actively adjusted their social media usage habits, such as deliberately browsing content outside their interests, following accounts with different perspectives, and turning off excessive personalized recommendation functions. For example, a participant from Germany said: „I used to only look at photography content, but now I will deliberately search for content about history and art. I also followed some historical scholars' accounts, which makes me exposed to more diverse information. I have also met friends who like history through these accounts." Participants also actively participated in offline activities to expand social networks beyond algorithm recommendations. A participant from India noted: „I think relying on algorithm recommendations

is not enough to expand my social circle. So I often participate in offline community activities, such as book fairs and cultural exhibitions. Through these activities, I can meet people with different backgrounds and interests, which helps me form more diverse social connections."

5. Discussion

5.1 Main Findings

The present study adopts a mixed-methods and cross-cultural approach to investigate the relationship between social media algorithm recommendation types (personalized interest recommendation vs. diverse social recommendation) and digital natives' social connection (emotional connection vs. behavioral connection), and the moderating role of information cocoon. The key findings are summarized as follows:

First, personalized interest recommendation and diverse social recommendation have differential effects on digital natives' social connection. Personalized interest recommendation has a significant positive effect on emotional connection and a weak positive effect on behavioral connection, as it helps digital natives find like-minded groups and strengthen existing emotional ties but is limited to narrow social circles. Diverse social recommendation has a significant positive effect on both emotional and behavioral connection, as it helps digital natives break through existing social limitations, contact diverse groups, and form new emotional and behavioral ties. This finding resolves the inconsistency in previous research by distinguishing between different types of algorithm recommendations and different dimensions of social connection (Chen & Lee, 2023; Qiu et al., 2023).

Second, information cocoon plays a significant moderating role in the relationship between diverse social recommendation and social connection but has no significant moderating effect on the relationship between personalized interest recommendation and social connection. For diverse social recommendation, high information cocoon weakens its positive effect on emotional and behavioral connection, as individuals

with high information cocoon are resistant to diverse information and cross-group contacts. For personalized interest recommendation, information cocoon does not significantly affect its relationship with social connection, as both high and low information cocoon individuals can only strengthen existing social circles through personalized recommendation. This finding clarifies the boundary conditions of the effect of algorithm recommendation on social connection and enriches the understanding of the role of information cocoon (Pariser, 2011; Wang et al., 2022).

Third, the patterns of relationships between algorithm recommendation types, information cocoon, and social connection are generally consistent across the five cultural contexts. Minor cross-cultural differences in the strength of the relationship between diverse social recommendation and behavioral connection do not alter the core mechanisms, suggesting that these relationships are relatively universal. This enhances the generalizability of the study's findings and supports the cross-cultural validity of the theoretical framework (Hampton et al., 2023; Barry et al., 2023).

5.2 Theoretical Implications

The present study makes several important theoretical contributions to algorithmic media and digital behavior research:

First, it enriches the literature on social media algorithm recommendation and social connection by distinguishing between different types of algorithm recommendations and exploring their differential effects on social connection dimensions. Previous research has often treated algorithm recommendation as a unidimensional construct, leading to conflicting findings (Bozdag, 2022; Sun et al., 2024). By demonstrating that diverse social recommendation promotes both emotional and behavioral connection while personalized interest recommendation only has a limited positive effect on social connection, the study provides a more nuanced understanding of the relationship between algorithm recommendation and digital natives' social outcomes.

Second, it identifies information cocoon as a key moderating mechanism linking algorithm recommendation to social connection. Previous research has focused on the direct effects of algorithm recommendation on social connection, neglecting the role of individual information environment characteristics (Pariser, 2011; Wang et al., 2022). By demonstrating that information cocoon weakens the positive effect of diverse social recommendation on social connection, the study fills this gap and contributes to the development of a more comprehensive theoretical model that incorporates the interaction between algorithm characteristics and individual information environment.

Third, it extends the concept of social connection to the algorithm-driven media environment for digital natives. By focusing on digital natives' social connection in the context of algorithm recommendation, the study provides insights into how algorithmic media shapes their social development. The findings suggest that digital natives' social connection can be either promoted or limited by algorithm recommendation, depending on the type of recommendation and the degree of information cocoon, reflecting the complex interaction between algorithmic technology and human social behavior in the digital era.

Fourth, the cross-cultural consistency of the findings enhances the theoretical generalizability of the relationships between algorithm recommendation types, information cocoon, and social connection. Previous research on algorithm recommendation and social connection has often been limited to single-country samples (Hampton et al., 2023; Chen & Lee, 2023). By demonstrating consistent patterns across diverse cultural contexts (individualistic and collectivistic), the study provides evidence that the psychological mechanisms underlying these relationships are relatively universal, strengthening the theoretical validity of the findings.

5.3 Practical Implications

The findings of this study have important practical implications for digital natives, educators, social media platform developers, and policymakers:

For digital natives: The study provides guidance

for using social media algorithm functions rationally to promote healthy social connection. Digital natives should actively utilize diverse social recommendation functions to expand their social horizons and avoid excessive dependence on personalized interest recommendation. They should also adopt active coping strategies to alleviate information cocoon, such as deliberately browsing diverse content, following accounts with different perspectives, and participating in offline activities to expand social networks beyond algorithm recommendations.

For educators: Schools and universities should integrate algorithm literacy education into the curriculum, focusing on teaching digital natives to understand the working mechanism of social media algorithms, recognize the potential risks of information cocoon, and master strategies for using algorithms rationally. Educational activities (e.g., group discussions, case studies) can be designed to help digital natives understand the differential effects of different algorithm recommendations on social connection and learn to balance personalized needs and diverse social development.

For social media platform developers: Platforms should optimize algorithm recommendation mechanisms to balance personalized needs and diverse information exposure. They can increase the proportion of diverse social recommendation content, develop functions that remind users of the degree of information cocoon, and provide personalized settings for recommendation diversity (e.g., allowing users to adjust the proportion of diverse content). Platforms can also design features that connect online diverse recommendations with offline activities, promoting the translation of online diverse exposure into offline social connection.

For policymakers: Policymakers should develop and implement policies to regulate social media algorithm recommendation and protect digital natives' diverse social development. This includes formulating algorithm transparency and fairness standards, requiring platforms to disclose recommendation mechanisms and provide diverse content options, supporting algorithm

literacy education programs, and encouraging research on the relationship between algorithmic media and digital natives' social outcomes. Policymakers can also collaborate with civil society organizations to raise awareness about the risks of information cocoon and the importance of diverse social connection.

5.4 Limitations and Future Research Directions

Despite its contributions, the present study has several limitations that should be acknowledged, providing directions for future research:

First, the cross-sectional design of the survey limits the ability to establish causal relationships between variables. While the moderation analysis provides insights into the potential mechanism, it cannot confirm the direction of causality. For example, it is possible that social connection also influences digital natives' algorithm usage habits and the degree of information cocoon. Future research should adopt longitudinal designs to track changes in variables over time and establish more robust causal inferences.

Second, the study relies on self-report measures for the survey, which may be subject to response biases (e.g., social desirability bias). Participants may overreport their exposure to diverse social recommendations and underreport the degree of information cocoon to align with societal expectations. Future research could complement self-report data with objective measures, such as behavioral tracking of algorithm recommendation exposure (e.g., platform usage data) and observational measures of social connection (e.g., offline interaction frequency).

Third, while the interview sample provides in-depth insights, it is relatively small (45 participants) and may not be fully representative of all digital natives. Future research could conduct larger-scale qualitative studies or mixed-methods studies with more diverse samples (e.g., digital natives from different educational backgrounds and socioeconomic statuses) to enhance the external validity of the qualitative findings.

Fourth, the study does not examine the role of

social media platform type in the relationship between algorithm recommendation and social connection. Different platforms (e.g., WeChat, Instagram, Facebook) have distinct algorithm recommendation mechanisms and user cultures, which may influence the type of algorithm recommendation and its relationship with social connection. Future research should explore how platform type moderates the relationships between variables.

Fifth, the study focuses on the moderating role of information cocoon, but other variables such as personality traits (e.g., openness, extraversion) and social support may also play a moderating or mediating role in the relationship between algorithm recommendation and social connection. For example, individuals with high openness may be more willing to accept diverse social recommendations and form new social connections. Future research could expand the scope of variables to explore their unique effects and mechanisms.

6. Conclusion

The present study systematically investigates the relationship between social media algorithm recommendation types (personalized interest recommendation vs. diverse social recommendation) and digital natives' social connection (emotional connection vs. behavioral connection), and the moderating role of information cocoon, using a mixed-methods and cross-cultural design. The findings reveal that diverse social recommendation positively predicts both emotional and behavioral social connection; personalized interest recommendation positively predicts emotional connection and weakly positively predicts behavioral connection; information cocoon moderates the relationship between diverse social recommendation and social connection but has no significant moderating effect on the relationship between personalized interest recommendation and social connection. These patterns are generally consistent across diverse cultural contexts.

This study contributes to algorithmic media

and digital behavior research by providing a nuanced understanding of the relationship between social media algorithm recommendation and digital natives' social connection, identifying information cocoon as a key moderating mechanism, and enhancing the generalizability of findings through a cross-cultural mixed-methods design. Practically, the study provides actionable insights for digital natives to use social media algorithm functions rationally, and for educators, platform developers, and policymakers to support digital natives' healthy social connection construction.

Future research should build on these findings by adopting longitudinal designs, using mixed methods with objective measures, and exploring the role of platform type, personality traits, and social support. Overall, this study advances our understanding of how algorithm-driven social media shapes digital natives' social connection, underscoring the importance of diverse algorithm recommendations and the need to alleviate information cocoon in promoting healthy social development in the digital era.

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