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Analysis of Information Media Preference Patterns Among New Student Admissions Using The Apriori Algorithm

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ABSTRACT

The new student admission process (PMB) at Universitas Lancang Kuning generates a large volume of questionnaire data each year, yet its use has been limited to frequency summaries without exploring the relationship between new students' profiles and the information media they use, so promotion strategies tend to rely on assumptions rather than data-driven evidence. This study applies the Apriori Algorithm to generate association rules between the demographic profile of new students and their information media preferences, and to identify the dominant pattern based on support, confidence, and lift values. A quantitative approach through association rule mining was used on 755 records of new students from the 2024 and 2025 cohorts, integrated from profile data and information-media questionnaire results. Data analysis involved preprocessing, data transformation, frequent itemset formation using the Apriori Algorithm, support and confidence calculation, and lift-ratio evaluation, and a χ^2 test of independence. The results reveal one valid association rule: {School Level = Senior High School} → {Information Media = Friends/Family/Relatives}, with a support of 24.64%, a confidence of 51.24%, and a lift ratio of 1.013. This association is weak and not statistically significant ($p = 0.73$). Word-of-mouth is the most-used channel overall (50.60%), and new students from senior high schools show only a slight tendency to rely on it; referral-based promotion should therefore be considered in future campus promotion strategies, supported by digital channels.

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1. INTRODUCTION

In the era of digital transformation and increasingly tight competition among higher-education institutions, new student admission (PMB) strategies can no longer rely on intuition alone but must be data-driven. Universitas Lancang Kuning, like many other institutions, faces the challenge of allocating a limited promotion budget to achieve optimal recruitment outcomes. Choosing promotion channels without a proper decision-support basis is a common obstacle that can waste resources without significantly increasing the number of new students (Iman, Sahibu, & Arda, 2021). Identifying the media that most effectively reach and are preferred by prospective-student segments is therefore essential.

Every admission period, the university collects a large volume of data, ranging from demographic profiles and school background to information-media surveys completed during registration. At Universitas Lancang Kuning, this questionnaire data has been digitally archived, but it is generally used only for administrative recapitulation or descriptive statistical reporting without further processing. This condition creates a phenomenon of meaningless "data chunks": a pile of registration forms with various attribute combinations has no strategic value unless it is mined and analyzed to reveal hidden patterns (Anas, Akhmadi, & Zebua, 2023). Meanwhile, prospective students' information-seeking behavior is known to be complex and shaped by accessibility and user-experience preferences (Heriyanto, 2020).

Although Universitas Lancang Kuning already records PMB data digitally—covering study program, school of origin, city and province of origin, and information media such as friends/family, the campus website, Instagram, brochures, WhatsApp, and other social media—the data is still processed shallowly, limited to frequency counts. No attempt has yet been made to relate new-student profile data to information-media data in order to reveal behavioral patterns. If the two datasets were connected, valuable insight could emerge regarding how different new-student segments seek admission information.

Three problems motivate this study. First, the institution possesses abundant data (755 active students from the 2024 and 2025 cohorts) that is not exploited for strategic decision-making. Second, promotion is still planned based on assumptions or past experience rather than data evidence, which risks misallocating the promotion budget—for instance spending heavily on a channel that a target segment does not actually trust. Third, without linking demographic profile to media preference, promotional messaging remains generic and undifferentiated, weakening the university's competitiveness in attracting new students.

This study proposes Association Rule Mining using the Apriori Algorithm to uncover information-media preference patterns based on new-student profiles. Apriori discovers attribute combinations that frequently co-occur and expresses them as "If-Then" rules—for example, if a student comes from a senior high school (SMA), then the student tends to rely on friends or family as an information source. Support and confidence measure how frequently and how strongly such a pattern occurs, while the lift ratio indicates whether the antecedent and the consequent co-occur more often than expected if they were independent.

Related work falls into three groups. First, Apriori has been applied in various academic and transactional settings, such as student grades (Khoiruzzidan & Iswari, 2024), course selection (Syahrul & Solichin, 2022), and retail transactions (Anggraini, Sanjaya, & Sa'ida, 2022), which shows its suitability for categorical institutional data. Second, association rules and related decision-support methods have been applied to admission data: grouping new-student registration data (Nasari, 2021), associating region of origin and school type with study-program choice (Artana & Utami, 2021), identifying major-selection trends (Sutoyo, Mardianto, & Palilling, 2024), relating first and second study-program preferences (Anas, Akhmadi, & Zebua, 2023), and supporting study-program selection (Sugiantoro, 2005); Anas (2020) used Apriori on new-student data to identify school types and majors to prioritize in promotion. Third, studies that focus on promotion media have used other approaches: media-priority weighting with the Analytical Network Process (Iman et al., 2021), an analysis of the

effectiveness of promotion media on new-student admission (Hidayati, Al Islam, & Akhmad, 2024), the use of social media to attract prospective students (Oktavian, Safitri, & Andini, 2025), and K-Means clustering, alone or combined with Apriori, to formulate promotion strategies (Arsyad, Nurlatifah, & Sunarmo, 2024; Hidayat & Munandar, 2024).

Research gap, novelty, and contribution. Across these studies, association rules have mainly been used to relate applicant attributes to study-program choice or to general promotion targets, whereas media-focused studies rely on weighting, clustering, or effectiveness analysis rather than rule discovery. To the best of the authors' knowledge, none of the studies reviewed has used association rules to relate new-student profile attributes to the information medium through which students learned about the university. The novelty and contribution of this study are therefore threefold: (1) it positions information media as the consequent of profile-based association rules; (2) it evaluates the rules with support, confidence, and lift, and additionally checks the strength of the resulting association with a χ^2 test; and (3) it translates the result into segment-specific recommendations for the promotion strategy of a private university in Riau.

Based on this gap, the study aims to (1) generate association rules between new-student profile and information-media preference, (2) identify the dominant preference pattern based on support, confidence, and lift, and (3) provide recommendations for the university's promotion strategy based on the resulting pattern.

2. METHODS

This study uses a quantitative approach through a data-mining technique, namely Association Rule Mining with the Apriori Algorithm, aimed at automatically discovering relationship patterns between new-student profile and information-media preference and evaluating the strength of those relationships statistically. The research was carried out in five stages: (1) data collection, (2) data preprocessing, (3) data transformation, (4) frequent-itemset mining and rule generation with Apriori, and (5) rule evaluation and validation (Sections 2.1–2.5).

2.1 Data Collection and Dataset Characteristics

Data were collected by documentation of secondary data from the digital archive of the New Student Admission (PMB) Division of Universitas Lancang Kuning. The unit of analysis is a new student, that is, a student admitted through PMB whose profile and information-media questionnaire answer were recorded at registration. The dataset contains 755 records of students who were active in the 2024 cohort (187 records) and the 2025 cohort (568 records). The new-student profile database and the information-media questionnaire results were joined by student ID. The antecedent attributes are School of Origin, City/Regency of Origin (74 categories), Province of Origin (16 categories), and Study Program (29 categories). The consequent attribute is Information Media (Friends/Family/Relatives, Official Website, Instagram, Brochure, WhatsApp, School Promotion Visit, TikTok, Facebook, and Other Online Media). Each new student reported exactly one information medium, so the consequent categories are mutually exclusive and their counts sum to 755 (Table 2). Because only enrolled students are included, the data describe the channels that reached students who eventually enrolled.

2.2 Data Preprocessing

Preprocessing consisted of data cleaning—removing irrelevant administrative attributes such as full name and national ID number, checking for missing values, and normalizing inconsistent spellings (e.g., "SMKN" vs. "SMK NEGERI")—and data selection, retaining School of Origin, City/Regency, Province, Study Program, and Information Media as the key attributes. After cleaning, all 755 records were complete and retained.

2.3 Data Transformation

Transformation comprised (a) concept-hierarchy generalization, grouping specific school names into School Level categories (SMA, SMK, MA, Transfer from Higher Education, Other) and grouping province of origin into RIAU/OUTSIDE RIAU, in order to reduce high cardinality and data sparsity; and (b) conversion of the tabular dataset into the binary (one-hot encoded) transaction format required by the Apriori Algorithm, in which each new student is one transaction and each attribute value is one item.

2.4 Apriori Mining and Parameter Setting

Frequent itemsets and candidate rules were generated with the Apriori implementation of the mlxtend library in Python (Google Colab). The minimum support was set at 10% (at least 76 of 755 records) and the minimum confidence at 50%. The 10% support threshold was chosen because the attributes are skewed and, even after generalization, partly sparse: it keeps profile segments large enough to matter for promotion decisions while excluding very rare combinations. The 50% confidence threshold is a majority criterion: a rule is retained only if at least half of the records containing the antecedent also contain the consequent. Apriori iteratively scans the transaction database to identify frequent itemsets from 1-itemset upward, pruning candidates below the minimum support at each level until no further frequent itemset can be formed. Candidate rules have the form A ⇒ B, where A is a profile attribute (or a combination of profile attributes) and B is an information medium. For every candidate rule, the following statistics were computed:

$$Support(A \epsilon B) = (Number\ of\ transactions\ containing\ A\ and\ B \div Total\ transactions) \times 100\%$$

$$Confidence(A, \quad B) = (Support(A \epsilon B) \div Support(A)) \times 100\%$$

$$Lift\ Ratio(A,B) = Confidence(A, \quad B) \div Support(B)$$

2.5. Rule Evaluation and Validity Criteria

Only rules meeting both the minimum-support and minimum-confidence thresholds were retained as candidate rules. Each retained rule was then evaluated with the lift ratio: a rule with lift > 1 was considered valid, that is, its antecedent and consequent co-occur more often than expected under independence, whereas a rule with lift ≤ 1 shows no positive association and was discarded. Because support, confidence, and lift describe frequency and direction but not statistical significance, the strength of the valid rule was additionally checked with a χ^2 test of independence on its 2 × 2 contingency table ($\alpha = 0.05$), with the φ coefficient as the effect size. The manual calculation was cross-validated against the Google Colab computation to confirm the correctness of the mining process (Section 3.3).

3. FINDINGS AND DISCUSSION

3.1 Classification Performance Evaluation

After cleaning, all 755 records were valid and complete for further processing. Of the 755 new students, 618 (81.85%) come from Riau Province, followed distantly by North Sumatra (51; 6.75%) and West Sumatra (34; 4.50%), indicating that the students reached so far are concentrated in Riau. Table 1 shows the distribution of new students by school level after generalization, and Table 2 shows the distribution of the information media used.

Table 1. Distribution of School Level of Origin

No	School Level	Number of Students	Percentage (%)
1	Senior High School (SMA)	363	48.08
2	Vocational High School (SMK)	245	32.45
3	Transfer from Higher Education	69	9.14
4	Islamic Senior High School (MA)	44	5.83
5	Other (non-formal education)	34	4.50
	Total	755	100.00

Table 1 shows that senior-high-school (SMA) graduates dominate with 48.08%, followed by vocational (SMK) graduates at 32.45%; together the two groups make up 80.53% of new students.

Table 2. Distribution of Information Media

No	Information Media	Number	Percentage (%)
1	Friends/Family/Relatives	382	50.60
2	Official Website	106	14.04
3	Instagram	95	12.58
4	Brochure	74	9.80
5	WhatsApp	53	7.02
6	School Promotion Visit	16	2.12
7	TikTok	10	1.32
8	Facebook	5	0.66
9	Other Online Media	14	1.86
	Total	755	100.00

Word-of-mouth (Friends/Family/Relatives) is the single most-used channel, accounting for more than half of all new students (50.60%), far ahead of any digital channel. The official website (14.04%) and Instagram (12.58%) rank second and third, together reaching 26.62% of new students, while short-video platforms such as TikTok (1.32%) and older social media such as Facebook (0.66%) remain marginal, and print brochures still retain relevance at 9.80%.

3.2 Frequent Itemset Formation and Candidate Rules

Applying the Apriori Algorithm with minimum support = 10% and minimum confidence = 50% produced frequent itemsets up to the 3-itemset level. From these, seven candidate rules with a profile attribute as the antecedent and Information Media as the consequent met the minimum support and were evaluated for confidence, as summarized in Table 3.

Table 3. Candidate Association Rules and Confidence Evaluation

No	Antecedent ز Consequent	Support (%)	Confidence (%)	Status
1	SMA ز Friends/Family/Relatives	24.64	51.24	Passed (≥ 50%)
2	SMK ز Friends/Family/Relatives	16.03	49.39	Rejected (< 50%)
3	RIAU ز Friends/Family/Relatives	40.79	49.84	Rejected (< 50%)
4	RIAU ز Official Website	11.52	14.08	Rejected (< 50%)
5	RIAU ز Instagram	10.33	12.62	Rejected (< 50%)
6	SMA, RIAU ز Friends/Family/Relatives	21.06	50.32	Passed (≥ 50%)
7	SMK, RIAU ز Friends/Family/Relatives	12.19	46.46	Rejected (< 50%)

Only two candidates met the 50% minimum-confidence threshold: rule (1) {SMA} ⇒ {Friends/Family/Relatives}, confidence 51.24% (186/363), and rule (6) {SMA, RIAU} ⇒ {Friends/Family/Relatives}, confidence 50.32% (159/316). All other candidates, including the seemingly strong {RIAU} ⇒ {Friends/Family/Relatives} (confidence 49.84%, only 0.16 points below the threshold), were discarded at the confidence stage.

3.3. Lift-Ratio Evaluation and the Valid Association Rule

The two surviving candidates were evaluated using the lift ratio, with Support(Friends/Family/Relatives) = 382/755 = 50.60% as the denominator. Results are summarized in Table 4.

Table 4. Lift-Ratio Evaluation of Candidate Rules

No	Association Rule	Support (%)	Confidence (%)	Lift Ratio	Status
1	{SMA} ز {Friends/Family/Relatives}	24.64	51.24	1.013	Valid (Lift > 1)
2	{SMA, RIAU} ز {Friends/Family/Relatives}	21.06	50.32	0.994	Not valid (Lift < 1)

Only rule (1) satisfies all three criteria (support ≥ 10%, confidence ≥ 50%, lift > 1) and is therefore the single valid association rule produced by this study: {School Level = SMA} ⇒ {Information Media = Friends/Family/Relatives}, with support = 24.64%, confidence = 51.24%, and lift ratio = 1.013. This was cross-checked against an independent Google Colab computation using the mlxtend library, which returned support = 24.6357%, confidence = 51.2397%, and lift = 1.0127—matching the manual calculation within rounding (two decimals for percentages, three for the lift ratio) and confirming the correctness of the mining process.

The rule can be interpreted as follows. The support of 24.64% means that 186 of 755 new students are both SMA graduates and users of the Friends/Family/Relatives channel, so the pattern covers a sizeable segment rather than a handful of cases. The confidence of 51.24% means that slightly more than half of the SMA graduates (186 of 363) reported personal recommendations as their information source, compared with 50.60% in the whole population and exactly 50.00% (196 of 392) among non-SMA new students. The lift ratio of 1.013 means that SMA graduates are only about 1.3% more likely to report this channel than the population baseline; the association is positive but very weak, which is expected because the consequent is already used by half of all new students and therefore keeps lift close to 1 for any antecedent. A χ^2 test of independence on the corresponding 2 × 2 contingency table, built from the counts above, confirms this: $\chi^2(1) = 0.12$, $p = 0.73$, $\varphi = 0.012$, so the difference between

SMA and non-SMA new students is not statistically significant. The rule is therefore valid under the pre-defined Apriori criteria but should be read as a descriptive, weak tendency; it does not show that school level influences, let alone causes, the choice of information medium.

3.4 Discussion

The dominance of word-of-mouth is notable given that digital platforms such as Instagram, TikTok, and the official website are all available promotion channels; word-of-mouth nonetheless remains the leading channel with a 50.60% share. However, it is not a sharply segment-specific pattern: the SMA rule is the only one that met all pre-defined thresholds, and it did so with a weak lift (1.013) and no significant difference from non-SMA students. Rules with SMK graduates or the RIAU province as antecedents fell just below the 50% confidence threshold (49.39% and 49.84%), which suggests that word-of-mouth is common across segments rather than characteristic of SMA graduates. Rules with digital media (Website, Instagram) as consequents were far below the threshold (12.62–14.08%), indicating that these channels are used by smaller and less predictable groups of new students.

These findings partly align with and partly differ from prior research. Iman, Sahibu, and Arda (2021) found that word-of-mouth ranked second (23.3%) behind the campus website (26.2%) as an effective promotion medium, whereas at Universitas Lancang Kuning word-of-mouth reaches 50.60%. The difference may reflect institutional or regional context, for example a strong culture of family- and community-based recommendation in Riau, but this explanation was not tested with the present data. Oktavian, Safitri, and Andini (2025) reported that social media such as Instagram, TikTok, and YouTube have become a primary information source for Generation Z; the present results agree only partly, since Instagram ranks third (12.58%) while TikTok (1.32%) and Facebook (0.66%) are among the least used channels. The data do not record the university's promotional activity on each platform, so it cannot be determined whether the low social-media share reflects limited activity or limited audience interest. Compared with earlier studies that ranked media (Iman et al., 2021) or associated profile with study-program choice (Artana & Utami, 2021; Anas et al., 2023), the present results show that the profile attributes available in PMB data discriminate only weakly between media users.

Practically, the findings suggest the following actions, which should be treated as hypotheses to be tested rather than as proven causal effects. First, because half of all new students learned about the university through friends, family, or relatives, referral-based promotion such as alumni-ambassador and student-referral programs is a sensible priority, with SMA graduates as the first target given their slight tendency. Second, promotional visits (roadshows) to SMA schools in Pekanbaru and surrounding regencies can extend personal contact to the school level. Third, the official website and Instagram, which together reach 26.62% of new students, should be maintained as secondary channels; whether new students from outside Riau rely more on digital channels could not be tested here because no candidate rule involving OUTSIDE RIAU reached the minimum support, and this should be examined in future work. Fourth, TikTok currently reaches only 1.32% of new students, so any investment should start as a low-cost pilot, since evidence of its importance for Generation Z comes from other studies (Oktavian et al., 2025). Fifth, alumni networks in North Sumatra and West Sumatra, which together account for 11.25% of new students (6.75% and 4.50%), could be involved to extend referral-based promotion beyond Riau.

This study has several limitations. First, the association found is weak (lift 1.013) and not statistically significant ($p = 0.73$), so it should be treated as a descriptive tendency rather than evidence of influence or causation. Second, the extreme dominance of the Friends/Family/Relatives consequent (50.60%) compresses lift values toward 1 across most candidate rules, limiting the ability to detect more specific patterns. Third, the Study Program (29 categories) and City/Regency of Origin (74 categories) attributes have high cardinality, producing sparse data that hinders frequent-itemset formation; higher-

level generalization (e.g., grouping study programs by faculty, or cities by administrative region) is recommended for future work. Fourth, only enrolled students from one institution and two cohorts (2024–2025) are included, so the data cannot show temporal shifts or the media used by applicants who did not enroll, and because each student reported a single medium, multi-channel exposure cannot be captured. Fifth, the secondary administrative data lack potentially relevant variables such as family income or social-media usage intensity, and the study does not benchmark Apriori against alternative association algorithms such as FP-Growth or Eclat.

4. CONCLUSION

The Apriori Algorithm was applied to 755 records of new-student profiles and information-media responses at Universitas Lancang Kuning. Of seven candidate rules, one met all pre-defined criteria (minimum support 10%, minimum confidence 50%, lift > 1): {School Level = SMA} ⇒ {Information Media = Friends/Family/Relatives}, with support = 24.64%, confidence = 51.24%, and lift ratio = 1.013. This is the dominant profile-based pattern, and Friends/Family/Relatives (word-of-mouth) is also the most-used information channel overall (50.60% of new students). The association is weak and not statistically significant ($\chi^2(1) = 0.12$, $p = 0.73$), so it describes a tendency rather than a causal influence of school level or of word-of-mouth on registration decisions. The results indicate that referral-based promotion deserves priority in the university's future new-student-admission strategy, supported by digital channels, while TikTok and other low-reach channels should be piloted before major investment. Future research should apply higher-level attribute generalization to reduce data sparsity, add variables such as household income or social-media usage intensity, compare Apriori with FP-Growth or Eclat, and use data from more than two admission cohorts, including applicants who did not enroll.

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Conflicts of Interest: The authors declare no conflict of interest.

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