

Analysis of Student Purchasing Patterns in a Campus Convenience Store Using Market Basket Analysis

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Abstract: Understanding customer purchasing patterns is essential for retailers to develop effective merchandising and promotional strategies. However, conventional transaction analysis is often limited to identifying the frequency of individual product purchases without revealing relationships among products purchased within the same transaction. This study aims to identify purchasing patterns among university students by applying Market Basket Analysis (MBA) using the Apriori algorithm. Primary data were collected from 100 purchase receipts obtained from students who shopped at a convenience store located in a university area. The transaction data were cleaned, grouped into 18 product categories, and transformed into a binary transaction matrix prior to analysis. The Apriori algorithm was implemented using a minimum support of 3% and a minimum confidence of 60%, while the resulting association rules were evaluated using lift values greater than one. The results indicate that Dairy (45%) and Bakery (43%) were the most frequently purchased product categories. The most frequent two-item combination was Bakery–Dairy, with a support value of 21%. Furthermore, nine association rules satisfied the predefined thresholds, with the strongest rule indicating that purchases containing Mineral Water and Body Care were consistently associated with Bakery purchases (confidence = 100%; lift = 2.33). However, this rule had a support of only 4%, indicating that it was observed in a limited number of transactions. Given the relatively small sample of 100 voluntary transactions collected at a specific campus convenience store, the findings should be interpreted as exploratory rather than representative of the broader student population. These findings provide initial insights into purchasing patterns and may support data-driven decisions related to product placement, merchandising, and promotional strategies in campus convenience stores, while further validation using larger transaction datasets is recommended.

Keywords: Apriori Algorithm, Market Basket Analysis, Convenience Store, Student Purchasing Behavior

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INTRODUCTION

Consumer purchasing behavior is a critical aspect of decision-making in the retail sector (Ramadhani & Ali, 2025). Changes in lifestyles, economic conditions, and demographic characteristics lead each consumer group to have distinct preferences and consumption patterns (Bhagya, 2021; Nasution et al., 2024). Understanding this behavior forms the foundation for retailers in determining strategies for product assortment, inventory management, product placement, and designing more effective promotional programs (Arnomo, 2021). In the digital era, transaction data generated through point-of-sale (POS) systems provides a rich source of

information to objectively identify consumer purchasing patterns based on actual transactions, thereby supporting data-driven retail decision-making (Ashari et al., 2022).

The presence of higher education institutions not only plays a role in educational development but also exerts an economic impact on the surrounding areas (Mohamad et al., 2021). As the dominant population in campus environments, student activities generate high demand for various goods and services, ranging from food, beverages, and personal necessities to other supporting services. This condition fosters the growth of various retail businesses around the campus, which largely rely on student consumption activities (Alfiesyah et al., 2022). Consequently, changes in student consumption patterns will, directly or indirectly, affect the operational strategies of retail businesses in that area.

One consumer group with interesting purchasing characteristics is students. Students generally have consumption patterns influenced by limited budgets, busy academic schedules, and the need for easy access to products (Olay Jr et al., 2025). Therefore, students' purchasing decisions tend to be influenced by factors such as price, product accessibility, and their daily consumption needs (Ramadhan & Surianto, 2023).

The consumption of ready-to-eat food, snacks, beverages, and personal care products is part of students' daily lives, especially for those living near campus or in rented accommodation (Musta'in & Wulansari, 2021). These characteristics create distinctive purchasing patterns that may differ from those of other consumer groups. Therefore, understanding students' purchasing behavior is important for retailers in providing products that meet the needs of this consumer group (Maulidiyah et al., 2026).

However, research on students' purchasing behavior is still largely dominated by survey-based approaches or consumer preference analyses based on respondents' perceptions. Although these approaches are able to explain the factors influencing purchasing decisions, they do not fully capture actual purchasing behavior as reflected in transaction data (Angelina & Astuti, 2024). In contrast, transaction data provide a more objective representation of consumer behavior because they record actual purchase activities, allowing researchers to identify products that are frequently purchased together.

One of the most widely used approaches to explore such relationships is *Market Basket Analysis* (MBA) through *association rule mining*. This approach identifies relationships among products based on transaction data and provides insights into consumer purchasing patterns (Rizaldi & Adnan, 2021). The resulting information can support decisions related to product placement, promotional strategies, and product category management (Rana & Mondal, 2021). However, most previous studies have focused on associations among individual products, resulting in a large number of association rules that are often difficult to interpret and less practical for managerial decision-making.

Based on this gap, this study aims to analyze students' purchasing patterns using *Market Basket Analysis* with a *product category approach* based on transaction data from a campus convenience store. Recent research has also highlighted the importance of analyzing purchasing relationships at the product-category level, particularly for understanding cross-category purchasing behavior and supporting retail decisions such as product recommendations and store layout (Hruschka, 2024). Grouping products into categories is expected to produce association patterns that are easier to interpret and more relevant for supporting product category management and marketing strategies in retail stores serving the student market.

METHOD

This study employed a quantitative approach with a descriptive-exploratory research design to identify purchasing patterns among students based on transaction data. The analysis was conducted using Market Basket Analysis (MBA) with the Apriori algorithm to identify association patterns among product categories that were frequently purchased together. The research procedure consisted of transaction data collection, data cleaning, product categorization,

construction of a binary transaction matrix, analysis using the Apriori algorithm, generation of association rules, and evaluation of the resulting rules using the support, confidence, and lift measures.

The study utilized primary data collected through direct field observations at a convenience store located within a university campus. Students who had completed their purchases were approached after leaving the store and were invited to voluntarily participate in the study. Upon obtaining consent, their purchase receipts were collected to record the product categories purchased, with each participant contributing only one transaction receipt. A total of 100 students participated in the study, resulting in 100 unique transactions used for the analysis. Data collection was conducted primarily during the afternoon, approximately between 15:00 and 18:00 Western Indonesian Time (WIB), during the regular academic semester. The dataset was collected specifically to explore co-purchasing patterns among students visiting the campus convenience store. Given the primary-data collection approach and voluntary participation of respondents, the dataset was treated as an exploratory sample rather than a statistically representative sample of the entire customer population. Therefore, the association rules identified in this study are interpreted as purchasing patterns observed within the collected transactions and are not intended to be generalized to all students or convenience store customers.

Prior to the analysis, the transaction data underwent a data cleaning process. This stage included standardizing product names, removing irrelevant data, and grouping different brands and product variants into product categories with similar characteristics. Product categorization was performed to reduce the complexity of the transaction data while generating association rules that were more interpretable than those obtained from analyses conducted at the individual Stock Keeping Unit (SKU) level. Based on this process, all products were classified into 18 product categories, as presented in Table 1.

Table 1. Product Classification

No	Category	Classification Criteria	Example Product
1	bakery	Bread and pastry products that are ready to eat without further preparation	White bread, filled bread
2	body_care	Products used for body care, skin conditioning, or personal grooming after or beyond basic cleansing	Deodorant, perfume
3	chocolate_candy	Chocolate and confectionery products, including chocolate bars, chocolate-coated wafers, and candies	KitKat, SilverQueen, Beng-Beng, M&M's, Relaxa, Fox's
4	coffee	Coffee-based beverages, including ready-to-drink coffee and instant coffee	Good Day, Kapal Api, Nescafé
5	dairy	Milk and dairy-based products	Ultra Milk, Indomilk, Milo UHT, Bear Brand, Yakult
6	fresh_food	Fresh food products that require refrigeration or have a relatively short shelf life	Fresh-cut fruit, salad, fresh yogurt
7	health	Health-related products, including over-the-counter medicines, vitamins, dietary supplements, and eye care products	Insto, Tolak Angin, Antangin, Promag, Vitamin C

No	Category	Classification Criteria	Example Product
8	household	Household products used for cleaning and home maintenance	Laundry detergent, fabric softener, floor cleaner, dishwashing liquid, household tissue
9	ingredients	Cooking ingredients and food seasonings used in meal preparation	Sugar, salt, chili sauce, soy sauce, cooking oil, instant seasoning
10	isotonic_drinks	Isotonic beverages formulated to replenish body fluids and electrolytes	Pocari Sweat, Mizone, Hydro Coco Isotonic
11	mineral_water	Bottled drinking water without added flavors or carbonation	Aqua, Le Minerale, Cleo, Ades
12	noodles	Instant noodle products requiring brewing or cooking before consumption	Indomie, Mie Sedaap, Pop Mie, Sarimi
13	personal_care	Products primarily used for routine personal hygiene and basic cleansing	Bath soap, shampoo, toothpaste, toothbrush, facial cleanser
14	ready_food	Food products ready for immediate consumption without additional cooking.	Onigiri, ready-to-eat rice, sandwich, rice bowl
15	smoking	Cigarettes and products associated with smoking	Cigarettes, lighter, lighter gas refill
16	snack	Snack foods excluding chocolate and confectionery products	Chitato, Qtela, Walens, Roma, Oreo, Tango, crackers
17	soft_drink	Flavored beverages, both carbonated and non-carbonated, excluding coffee, tea, dairy beverages, mineral water, and isotonic drinks	Coca-Cola, Sprite, Fanta, Fruit Tea Sparkling, Tebs
18	tea	Tea-based beverages, including ready-to-drink tea and brewed tea products	Teh Botol Sosro, Teh Pucuk, Frestea, Nu Green Tea

The categorized transaction data were subsequently converted into a binary transaction matrix. In this matrix, each row represents a single transaction, while each column corresponds to a product category. A value of 1 indicates that the product category was included in the transaction, whereas a value of 0 indicates that the category was not purchased. This binary representation serves as the input for the Apriori algorithm in the process of identifying frequent itemsets.

Purchasing pattern analysis was conducted using the Apriori algorithm, one of the widely used techniques in Association Rule Mining (ARM). The algorithm identifies combinations of product categories that frequently occur together based on a minimum support threshold and subsequently generates association rules using a minimum confidence threshold. In this study, the quality of the generated association rules was evaluated using three standard measures: support, confidence, and lift (Purwati & Karnila, 2023).

a. Support

Support represents the proportion of transactions containing a particular product category or combination of product categories relative to the total number of transactions analyzed.

$$Support(A \rightarrow B) = \frac{n(A \cap B)}{N} \quad (1)$$

b. Confidence

Confidence represents the conditional probability that product category B is purchased given that product category A has been purchased in the same transaction.

$$Confidence(A \rightarrow B) = \frac{Support(A \cap B)}{Support(A)} \quad (2)$$

c. Lift

Lift measures the strength of the association between product categories by comparing their observed co-occurrence with the expected co-occurrence if the two categories were statistically independent.

$$Lift(A \rightarrow B) = \frac{Confidence(A \cap B)}{Support(B)} \quad (3)$$

In this study, the minimum support threshold was set at 3%, while the minimum confidence threshold was 60%. These thresholds were selected by considering the number of transactions analyzed, ensuring that the resulting association rules adequately represented meaningful purchasing patterns without generating an excessive number of less relevant rules.

The resulting association rules were further evaluated using the lift metric to assess the strength of the relationships between product categories. A higher lift value indicates a stronger association than would be expected by random chance. Specifically, a lift value greater than 1 indicates a positive association between product categories, a value equal to 1 indicates that the categories are statistically independent, and a value less than 1 indicates a weaker association than would be expected under independence. Association rules satisfying the predefined support, confidence, and lift thresholds were subsequently analyzed to identify students' purchasing patterns and interpreted as a basis for developing recommendations regarding product category management and promotional strategies for the campus convenience store.

RESULT AND DISCUSSION

Descriptive Analysis of Transaction Data

The analysis was conducted using transaction data collected from customer purchase receipts at a convenience store located within a university campus. Each receipt represented a single purchase transaction and was subsequently transformed into a binary transaction matrix based on product categories. Following the data cleaning and product categorization processes, a total of 18 product categories were identified and used as the basis for analyzing students' purchasing patterns through the Market Basket Analysis (MBA) approach.

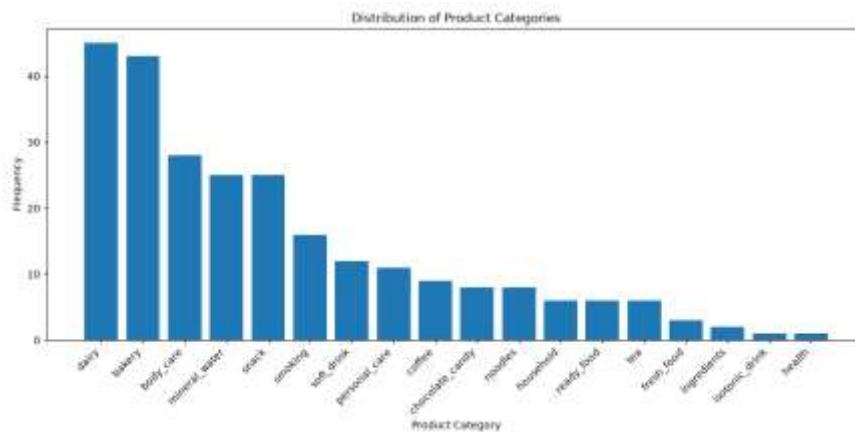


Figure 1. Distribution of Product Categories

As shown in Figure 1, the Dairy category appeared most frequently in the transaction data, accounting for 45% of all transactions, followed by Bakery at 43%. In addition, the Body Care, Snacks, and Mineral Water categories also exhibited relatively high purchase frequencies compared with the remaining categories. These findings indicate that students' purchases were primarily dominated by food, beverages, and personal care products required for their daily activities.

The high purchase frequencies observed for the dairy and bakery categories suggest that these products constitute routine consumption among students. Products within these categories are generally convenient, readily available, and can be consumed immediately, making them well suited to students' busy academic schedules. This interpretation is consistent with previous research indicating that university students tend to purchase ready-to-eat foods and beverages more frequently than foods requiring longer preparation times (Martinez-Perez et al., 2022). Meanwhile, the relatively high purchase frequency of the Snacks category suggests that students not only purchase products to satisfy their primary needs but also buy snack items to complement their daily activities while on campus.

In contrast, categories such as household, ready-to-eat food, tea, and health exhibited relatively low purchase frequencies. This finding indicates that these categories are not routinely purchased in every transaction but are instead purchased only when specific needs arise. Although the frequency distribution provides an overview of the relative popularity of each product category, it does not reveal which categories are likely to be purchased together within the same transaction. Therefore, the next stage of the analysis involved Frequent Itemset Analysis to identify combinations of product categories that frequently co-occur, providing the basis for generating association rules.

Frequent Itemset Analysis

Frequent itemset analysis was performed using the Apriori algorithm to identify combinations of product categories that frequently occurred together within the same transaction. In this study, the minimum support threshold was set at 3%, meaning that only combinations of product categories meeting or exceeding this threshold were retained for further analysis. The resulting frequent itemsets are presented in Table 2.

Table 2. Frequent Itemset Analysis	
Frequent Itemset	Support
bakery	0.43
body_care	0.28

Frequent Itemset	Support
chocolate_candy	0.08
coffee	0.09
dairy	0.45
fresh_food	0.03
household	0.06
mineral_water	0.25
noodles	0.08
personal_care	0.11
ready_food	0.06
smoking	0.16
Snack	0.25
soft_drink	0.12
tea	0.06
bakery, body_care	0.13
bakery, chocolate_candy	0.05
bakery_coffee	0.04
bakery, dairy	0.21
mineral_water, bakery	0.12

Based on Table 2, in addition to individual product categories with high purchase frequencies, several combinations of product categories were also found to occur frequently within the same transaction. The combination of Bakery and Dairy was the most frequent two-item itemset, with a support value of 21%. This was followed by the combinations Bakery–Body Care and Dairy–Body Care, each with a support value of 13%. In addition, combinations involving Mineral Water and Snacks also satisfied the minimum support threshold, although their occurrence was relatively less frequent.

The presence of these frequent itemsets indicates that students tend to purchase products from multiple categories during a single visit to the convenience store. The Bakery–Dairy combination suggests a tendency for students to purchase ready-to-eat food and beverages together as part of their daily consumption needs (Martinez-Perez et al., 2022). Meanwhile, the co-occurrence of Body Care products with either Bakery or Dairy indicates that students frequently combine purchases of food and beverages with personal care products within the same transaction. This pattern suggests that visits to the convenience store are intended not only to satisfy a single need but also to fulfill multiple daily needs simultaneously. The relatively high support values of several two-item combinations also indicate that these purchasing patterns are not isolated occurrences but are repeatedly observed across the transaction dataset. In particular, the 21% support of the Bakery–Dairy combination means that this pair appeared in approximately one out of every five transactions, making it the most prominent product combination identified in the frequent itemset analysis.

In addition to identifying the most frequent product combinations, the frequent itemsets also provide an overview of students' general shopping behavior. Most of the identified itemsets involve food and beverage categories, such as Bakery, Dairy, and Mineral Water, indicating that convenience-oriented products dominate purchasing decisions. This finding is consistent with the characteristics of campus convenience stores, where customers typically make short shopping trips and prioritize products that can be consumed immediately or require minimal preparation. Furthermore, the presence of itemsets combining food products with Body Care suggests that students often purchase products from different consumption categories within a single visit, reflecting the multifunctional role of convenience stores in meeting both immediate consumption and personal daily needs

Although Frequent Itemset Analysis is effective in identifying combinations of product categories that frequently co-occur, it does not indicate the strength or direction of the relationships between those categories. Therefore, the next stage of the analysis employed Association Rule Analysis to evaluate the relationships among product categories using the support, confidence, and lift metrics.

Association Rule Analysis

Association Rule Analysis was conducted to identify purchasing relationships among product categories based on the frequent itemsets obtained in the previous stage. In this study, a minimum confidence threshold of 60% was applied, and only association rules with a lift value greater than 1 were retained. Consequently, the resulting rules represent positive associations between product categories. The association rules satisfying these criteria are presented in Table 3.

Table 3. Association Rules

Antecedent	Consequent	Support	Confidence	Lift
chocolate_candy	bakery	0.05	0.625	1.45
household	body_care	0.04	0.667	2.38
chocolate_candy	dairy	0.05	0.625	1.39
tea	dairy	0.04	0.667	1.48
mineral_water, body_care	bakery	0.04	1.000	2.33
bakery, chocolate_candy	dairy	0.04	0.800	1.78
chocolate_candy, dairy	bakery	0.04	0.800	1.86
bakery, coffee	dairy	0.03	0.750	1.67
coffee, dairy	bakery	0.03	0.600	1.40

As shown in Table 3, all generated association rules have lift values greater than 1, indicating positive relationships among product categories. In other words, the presence of one product category increases the likelihood of another category being purchased within the same transaction compared with what would be expected by random chance. Furthermore, confidence values ranging from 60% to 100% indicate that most of the generated rules exhibit a relatively high level of reliability in describing students' purchasing behavior.

The rule {Mineral Water, Body Care} → {Bakery} yielded the highest confidence value of 100%, with a lift of 2.33. This indicates that all transactions containing both Mineral Water and Body Care also included Bakery in the collected dataset. However, the rule had a support of only 4%, corresponding to four transactions, so the high confidence should be interpreted cautiously as an exploratory pattern rather than a dominant purchasing behavior. The lift value indicates that Bakery occurred more frequently in transactions containing Mineral Water and Body Care than would be expected based on its overall occurrence in the dataset. Although the specific motivation behind this cross-category purchase cannot be determined from the available data, the observed co-occurrence is consistent with the concept of multicategory purchasing, in which consumers may purchase multiple product categories within the same shopping occasion. Therefore, this rule provides an interesting indication of cross-category purchasing behavior, but requires validation using a larger transaction dataset before being considered a general purchasing pattern.

In addition to the rule with the highest confidence, several other association rules also provide meaningful insights into students' purchasing behavior. For example, the rule {Chocolate & Candy} → {Bakery} achieved a confidence value of 62.5% with a lift of 1.45, indicating that students purchasing confectionery products were also likely to purchase bakery items within the same transaction. Likewise, the rule {Chocolate & Candy} → {Dairy} yielded the same confidence value but a slightly lower lift (1.39), suggesting that dairy products are also commonly purchased

together with confectionery items. These findings imply that snack-oriented purchases among students are often complemented by beverages or bakery products, reflecting spontaneous consumption behavior during academic activities. Another notable finding is the association between Household and Body Care, which produced a confidence value of 66.7% and the highest lift among all two-item rules (2.38). Although this rule was supported by only 4% of the transactions, the high lift indicates that customers purchasing household products were substantially more likely to purchase body care products than would be expected by chance. This purchasing pattern suggests that customers tend to purchase household necessities and personal care products during the same shopping trip, indicating that these products may complement one another in routine shopping behavior.

The association rules involving three product categories further demonstrate the capability of the Apriori algorithm to uncover more complex purchasing patterns. The rule {Bakery, Chocolate & Candy} → {Dairy} achieved a confidence value of 80% with a lift of 1.78, while the rule {Chocolate & Candy, Dairy} → {Bakery} also produced a confidence value of 80% with an even higher lift of 1.86. These results indicate that when students purchase confectionery products together with either bakery or dairy products, they are highly likely to complete the purchase with the remaining complementary category. Such purchasing patterns suggest that these products function as complementary items rather than substitutes, making them suitable candidates for integrated merchandising strategies and bundled promotional offers.

From a retail management perspective, the identified purchasing patterns confirm the usefulness of Market Basket Analysis in revealing complementary relationships among product categories. Such information extends beyond describing purchasing behavior by providing empirical evidence that can support retail decision-making. These findings demonstrate that the generated association rules can provide valuable insights for operational decision-making in convenience stores. Product categories with strong purchasing relationships may be strategically placed in adjacent shelf locations to facilitate customers in finding products that are frequently purchased together. Furthermore, these results can serve as a basis for designing bundle promotions, cross-selling strategies, and product recommendation systems aimed at increasing customers' transaction values. Therefore, Association Rule Analysis not only reveals students' purchasing patterns but also provides practical evidence to support merchandising and promotional strategies in campus convenience stores.

CONCLUSIONS

This study identified students' purchasing patterns at a convenience store located within a university campus using Market Basket Analysis (MBA) with the Apriori algorithm. The results showed that Dairy and Bakery were the most frequently purchased product categories, while the Bakery–Dairy combination was the frequent itemset with the highest support value. Furthermore, the Association Rule Analysis revealed several purchasing associations among product categories, indicating co-occurrence between multiple product categories within the observed transactions.

From a practical perspective, these findings can provide an initial basis for developing merchandising strategies, product placement, and combination-based promotional programs at campus convenience stores. For example, the observed associations among Bakery, Dairy, and Chocolate & Candy suggest the potential for a “Study Session Pack” combining a bakery item, a dairy beverage, and a chocolate or confectionery product. Similarly, product categories with observed purchasing associations can be positioned relatively closer together to facilitate related purchases. However, these recommendations should be considered exploratory because the analysis was based on 100 voluntary transactions collected primarily during the afternoon at a specific campus convenience store. Future research is recommended to employ larger transaction datasets collected over longer observation periods, preferably using POS data with transaction timestamps, to validate the identified association patterns and provide stronger evidence for merchandising, product placement, and bundling strategies.

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