

Improving Cosmetic Safety Awareness Through an Educational Program and Hands-On Workshop on a Pomegranate-Based Peel-Off Mask for Adolescents

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Abstract

Adolescents are increasingly exposed to cosmetic products and marketing claims, yet their awareness of cosmetic safety remains limited. Interactive educational approaches that combine theoretical knowledge with practical experience are still rarely implemented. This study aimed to evaluate the effectiveness of an interactive educational intervention in improving adolescents' knowledge of cosmetic safety and the appropriate use of skincare ingredients. A quasi-experimental study with a one-group pretest–posttest design was conducted on December 3, 2025, involving $n = 61$ high school students. The intervention integrated BPOM-based education with a hands-on workshop on peel-off mask formulation. Knowledge was assessed using a 10-item questionnaire, which was pilot-tested for clarity and relevance. Data were analyzed using a paired t-test ($p < 0.05$). The mean knowledge score increased from 72.71 ± 16.72 to 84.67 ± 10.45 , with a statistically significant difference ($p = 0.002$) and a large effect size (Cohen's $d = 1.36$). The distribution of scores shifted toward higher categories, indicating improved understanding. Participants also reported high levels of satisfaction with the program. The intervention effectively improved adolescents' knowledge of cosmetic safety. The novelty lies in integrating regulatory education with hands-on formulation activities as an interactive learning model. However, the absence of a control group and the single-setting design limit generalizability.

Keywords

Adolescents; Cosmetic safety; Peel-off mask; Skincare; Workshop



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1. INTRODUCTION

The global cosmetic industry continues to expand rapidly, with revenues projected to exceed USD 800 billion by 2030 (Statista Research Department, 2023). In Indonesia, cosmetic product registrations have increased substantially, rising from 2,072–6,358 products in 2022 to 5,614–11,912 products in 2025. Additionally, hundreds of cosmetic industries are concentrated in major provinces such as West Java, East Java, and Banten (Badan Pengawas Obat dan Makanan, 2025a, 2025b). These data indicate a strong and continuously growing cosmetic industry.

This rapid expansion is accompanied by increasing cosmetic consumption, particularly among adolescents. Adolescence represents a critical developmental stage characterized by heightened attention to physical appearance, identity formation, and sensitivity to peer perception. Previous studies have demonstrated that self-esteem and psychosocial factors influence cosmetic use behavior (Yin et al., 2025; Orth et al., 2018; Von Soest et al., 2018). In parallel, marketing strategies that emphasize attractiveness and self-confidence further position adolescents as a vulnerable consumer group.

Despite this growth, safety concerns remain significant. The term “toxic beauty” refers to the presence of potentially harmful chemical substances in cosmetic products that may pose risks to human health (Chaves et al., 2020). For instance, phthalates—commonly used in plastics and fragrances—have been associated with developmental and reproductive disorders (Bilal & Iqbal, 2019). Furthermore, regulatory monitoring systems such as RAPEX reported more than 150 cases of cosmetic products containing banned or hazardous substances between 2018 and 2023 (Vieira et al., 2024). These findings indicate that unsafe products continue to circulate in the market despite regulatory control.

In addition to safety risks, purchasing behavior is influenced by consumer perception and attitude. Evidence suggests that perceived price and consumer attitude significantly affect purchase intention, while knowledge alone often requires attitudinal mediation to influence decision-making (Dlamini & Mahowa, 2024). This highlights that improving knowledge alone may be insufficient to promote safe cosmetic use.

However, previous studies have not specifically addressed structured cosmetic safety education targeting adolescents at the community level. Existing efforts predominantly focus on regulatory surveillance and market control, with limited emphasis on preventive, practice-based education. In particular, there is a lack of interactive educational approaches, such as workshops, that enable adolescents to

develop practical skills in evaluating cosmetic safety. This gap indicates that current strategies may not adequately equip adolescents with the necessary competencies to make informed decisions.

Therefore, this study proposes a community-based cosmetic safety education program combined with a hands-on workshop approach. The integration of education and practical activities is expected to bridge the gap between knowledge and behavior by enhancing understanding, shaping attitudes, and improving decision-making skills related to cosmetic use. The objectives of this study are to evaluate the effectiveness of a cosmetic safety education intervention in improving adolescents' knowledge and attitudes toward cosmetic products. This study contributes practically by providing an applicable educational model for adolescent-targeted cosmetic safety programs, and academically by offering evidence on the effectiveness of integrated, practice-based interventions in promoting safe cosmetic use.

2. METHODS

This study employed a one-group pretest–posttest design to evaluate the effectiveness of a community-based cosmetic safety education intervention. The intervention consisted of two main components: a structured educational session and a hands-on workshop on peel-off mask formulation. This design was selected to assess changes in participants' knowledge before and after the intervention. The study was conducted offline on 3 December 2025 at Sekolah Kristen IPEKA Tomang. The target population consisted of high school students, and a total of 61 participants from grades X and XI were included in the study. A total sampling technique was applied. Basic participant characteristics, namely gender distribution, were recorded.

The first stage was an interactive educational session on cosmetic safety delivered using structured presentation materials. The content was based on a prepared module titled "Is Your Cosmetic Product Safe?" It covered key topics including the regulatory definition of cosmetics, BPOM regulations on cosmetic claims, identification of hazardous ingredients (e.g., mercury and its derivatives), suspicious marketing practices, safe purchasing behavior, and proper use of active ingredients such as retinoids, AHA/BHA, sunscreen, and benzoyl peroxide. The session incorporated visual presentations, real-case examples, and guided discussions to promote active engagement and critical awareness among participants.

The second stage was a hands-on workshop on formulating a pomegranate-based peel-off mask. This workshop aimed to introduce participants to basic cosmetic formulation principles while emphasizing safety, hygiene, and proper handling of ingredients in cosmetic preparation. The formulation used in this activity was adapted

from a previously published peel-off mask base formula (Rachmawati et al., 2025), with modification of the active ingredient. Participants were introduced to the function of each ingredient, basic formulation principles, and hygiene considerations. The preparation process involved dispersing polyvinyl alcohol (PVA) in distilled water at approximately 70°C, followed by cooling, incorporation of active ingredients mixed with propylene glycol, addition of preservative, and adjustment to the final volume. Students actively participated in small groups and performed each step under supervision, enabling experiential learning of formulation processes.

Table 1. Formula of Pomegranate-Based Peel-Off Mask

Materials	Concentration (%)
Pomegranate herbs powder	4%
Pomegranate herbs granules	11%
Propylene glycol	7.5%
Methylparaben	0.1%
PVA (Polyvinyl alcohol)	12.5%
Distilled water	Ad 100%

To assess the effectiveness of the intervention, a pretest and posttest were administered before and after the activity using a structured, multiple-choice questionnaire with 10 items on cosmetic safety. The instrument referred to a previous study (Rachmawati, 2024). A pilot test was conducted prior to implementation to ensure clarity and suitability of the questions. The questionnaire included the following items:

1. Based on BPOM regulations, cosmetic claims must not resemble:
 - A. Herbal products
 - B. Food products
 - C. Medicinal products
 - D. Hair care products
 - E. Dietary supplements
2. Which of the following ingredients indicates a hazardous cosmetic product and must be discontinued?
 - A. Niacinamide
 - B. Mercurous chloride
 - C. Hyaluronic acid
 - D. Panthenol
 - E. Zinc oxide

3. The correct statement regarding mercury-containing products is:
 - A. Safe for daily use if skin is not sensitive
 - B. Does not cause any skin effects
 - C. May cause irritation, redness, and itching
 - D. Only dangerous when combined with retinol
 - E. Safe if not exposed to sunlight
4. Cosmetic products that should be suspected of containing hazardous substances are those that:
 - A. Moisturize skin within four weeks
 - B. Claim to whiten skin within a few days
 - C. Have SPF 30
 - D. Contain chamomile
 - E. Are facial cleansers for acne
5. Purchasing cosmetics from appropriate sources is important because it relates to:
 - A. Product durability
 - B. Aroma and color
 - C. Product authenticity and quality
 - D. Vitamin content
 - E. Lower price
6. Retinol/retinoids should preferably be used:
 - A. In the morning, before sunscreen
 - B. During the day after meals
 - C. At night with gradual frequency
 - D. Every two hours
 - E. Mixed with AHA/BHA on the same night
7. AHA/BHA should not be used simultaneously with:
 - A. Sunscreen
 - B. Facial cleanser
 - C. Retinol
 - D. Body lotion
 - E. Vitamin C serum
8. Sunscreen is used in the following ways, except:
 - A. Applied as the last step of morning skincare
 - B. Minimum SPF 30
 - C. Reapplied every 2–3 hours

- D. Used only during hot weather
- E. Applied 15 minutes before going outside
- 9. Benzoyl peroxide products are used to:
 - A. Treat acne with a thin application at night
 - B. Exfoliate dead skin cells
 - C. Moisturize skin
 - D. Reduce fine wrinkles
 - E. Remove excess oil
- 10. The BPOM notification number on cosmetic packaging indicates that the product:
 - A. Has been evaluated and registered with BPOM
 - B. Is imported from another country
 - C. Contains natural ingredients
 - D. Is recommended by dermatologists
 - E. Is safe for all skin types

Pretest and posttest scores were analyzed using descriptive and inferential statistics. Descriptive analysis included mean scores and the percentage of correct answers. Inferential analysis was conducted using a paired t-test to assess differences before and after the intervention, with $p < 0.05$ set as the threshold for statistical significance. The intervention was considered successful if the posttest mean score reached ≥ 80 the difference was statistically significant ($p < 0.05$). In addition to knowledge assessment, participant satisfaction was evaluated using a structured questionnaire. Questions 1–7 were assessed using a five-point Likert scale ranging from 1 (very dissatisfied) to 5 (very satisfied). Questions 8–9 were open-ended questions to obtain qualitative feedback. The satisfaction data were analyzed descriptively by calculating frequency distributions and mean scores for each item. The satisfaction instrument consisted of the following items:

1. Was today's Campus Visit enjoyable?
2. How did the student mentors/organizing team provide the service?
3. How were the facilities provided to support the workshop activities?
4. What is your overall level of satisfaction with the entire series of activities?
5. Was the topic of the activity interesting?
6. Was the topic relevant to your needs?
7. Did each question or concern receive an appropriate response?
8. What topics would you like to be included in future activities?
9. What are your impressions and suggestions regarding today's activity?

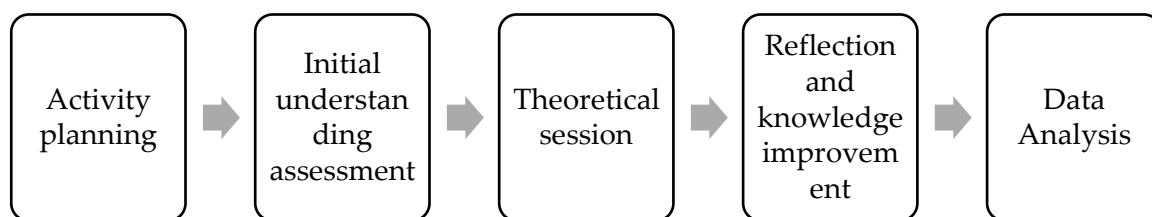


Figure 1. Flowchart of Cosmetic Safety Education

3. FINDINGS AND DISCUSSION

3.1 Demographic of Participants

The demographic characteristics of the participants are presented in Figure 1. Based on gender distribution, the participants were 49% male and 51% female. This relatively balanced distribution indicates that both male and female students were almost equally represented in the activity. All participants were students in grade X (tenth grade), meaning they were at a similar educational level and generally within the same age group. This uniformity in academic level helps ensure that the participants have relatively comparable baseline knowledge and learning capacity when engaging in the educational activities.

The balanced gender composition and homogeneous educational background provide a suitable context for evaluating the effectiveness of the educational intervention. Since all participants came from the same grade level, differences in knowledge improvement and satisfaction responses are less likely to be influenced by variations in educational stage, allowing the results to reflect the impact of the activity itself more accurately.

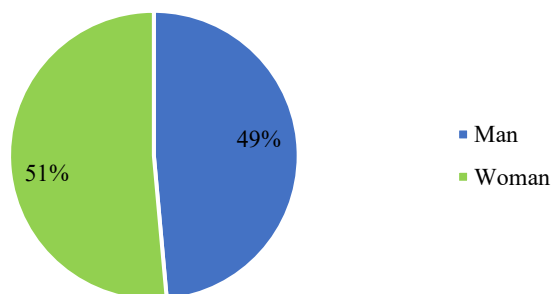


Figure 2. Demographic Characteristics of the Participants

3.2 Evaluation of Interactive Education and Workshop on Cosmetic Safety Knowledge

As shown in Figure 2, the percentage of correct answers increased for most questions from pretest to posttest, indicating an overall improvement in participants' knowledge after the educational intervention.

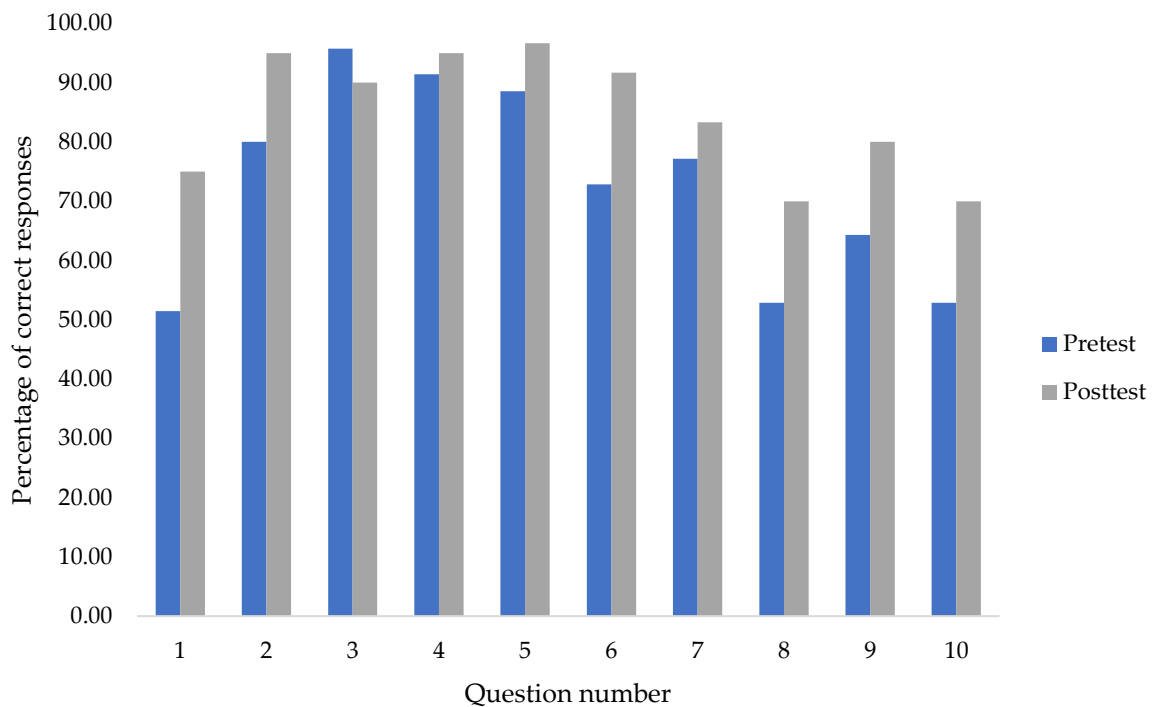


Figure 3. The Percentage of Correct Response from Pretest to Posttest

For question 1, which addressed the prohibition on cosmetic claims resembling medicinal products under BPOM regulations, the percentage of correct answers increased from approximately 51% in the pretest to 75% in the posttest. This result indicates that prior to the educational session, some participants had a limited understanding of the regulatory boundaries for cosmetic claims. After the intervention, more participants recognized that cosmetic products are not allowed to make medicinal claims.

For question 2, which focused on identifying hazardous cosmetic ingredients, particularly mercurous chloride, the percentage of correct responses increased from around 80% to 95%. This suggests that many participants already possessed basic knowledge regarding harmful cosmetic substances, and the educational session further reinforced this understanding.

In question 3, concerning the effects of mercury-containing products on the skin, the percentage of correct answers slightly decreased from about 96% in the pretest to

90% in the posttest, although the value remained relatively high. This indicates that most participants were already aware of the harmful effects of mercury in cosmetics, and the slight decline may reflect variations in how the question was interpreted during the posttest.

For question 4, which discussed warning signs of cosmetic products potentially containing hazardous substances, particularly claims of rapid skin whitening within a few days, the percentage of correct answers increased from approximately 92% to 95%. This suggests that participants increasingly understood that unrealistic cosmetic claims may indicate the presence of unsafe ingredients.

In question 5, regarding the importance of purchasing cosmetics from reliable sources, the percentage of correct answers increased from around 89% to 97%. This improvement indicates that participants became more aware that purchasing from appropriate sources is closely related to product authenticity and quality assurance.

For question 6, which addressed the appropriate use of retinol, preferably at night with gradual frequency, a notable improvement was observed, with correct responses increasing from approximately 73% in the pretest to 92% in the posttest. This finding indicates that the educational intervention successfully improved participants' understanding of the safe use of active skincare ingredients.

In question 7, which examined the interaction between active ingredients, particularly the recommendation to avoid simultaneous use of AHA/BHA with retinol, the percentage of correct answers increased from about 77% to 84%, indicating improved awareness of the potential for skin irritation when combining certain active ingredients.

For question 8, which evaluated knowledge about proper sunscreen use, the percentage of correct responses increased from approximately 53% to 70%. This result suggests that prior to the intervention, many participants believed sunscreen was only necessary during hot weather. After the educational session, participants better understood that sunscreen should be used regularly as part of daily skincare.

In question 9, which addressed the function of benzoyl peroxide in acne treatment, the percentage of correct answers increased from around 65% to 80%, reflecting improved knowledge regarding the role of active ingredients in acne management.

For question 10, which examined the meaning of the BPOM notification number on cosmetic packaging, the percentage of correct answers increased from approximately 53% to 70%. This indicates that before the intervention, some participants were unaware that the BPOM notification number signifies that the

product has been registered and evaluated by the regulatory authority. After the educational session, participants demonstrated a better understanding of the importance of the legality of cosmetic products.

Overall, the increase in correct responses across most questions, as illustrated in Figure 2, indicates that the educational intervention was effective in improving participants' knowledge regarding cosmetic safety, BPOM regulations, and the safe use of active skincare ingredients. The most notable improvements were observed in topics that were initially less well understood, such as cosmetic claim regulations, proper sunscreen use, and the significance of BPOM notification numbers.

As shown in Figure 3, the distribution of scores shifted from the pretest to the posttest, indicating an improvement in participants' knowledge after the educational activity. In the pretest, the score distribution was still widely spread across the mid-range, particularly in the 50–80 interval. In contrast, the proportion of participants achieving very high scores remained relatively limited. In contrast, after the learning intervention, the distribution of posttest scores shifted toward higher values.

During the pretest, a considerable number of participants clustered in the 50–70 score range, suggesting that their initial understanding of cosmetic safety, the use of active skincare ingredients, and BPOM regulations remained moderate. In addition, several participants scored in the 20–40 range, indicating that some had limited prior knowledge of these topics before the educational intervention.

Following the educational session, the distribution of posttest scores changed noticeably. The proportion of participants achieving higher scores increased, particularly in the 90–100 range. This indicates that more participants answered most questions correctly after receiving the educational materials. A particularly clear improvement was observed in the 100-point category, suggesting that more participants achieved an excellent level of understanding of the topics presented.

The mean pretest score was 72.71 ± 16.72 , which increased to 84.67 ± 10.45 in the posttest, indicating an improvement of 11.95 points. Paired t-test analysis revealed a statistically significant difference between pretest and posttest scores ($t(9) = 4.31$, $p = 0.002$). The 95% confidence interval ranged from 5.68 to 18.22, confirming the consistency of the improvement. The effect size was large (Cohen's $d = 1.36$), indicating a substantial practical impact. Overall, posttest scores were higher across most items, with only one item showing a slight decrease. The mean posttest score exceeded the predefined success indicator of 80, suggesting that the intervention was effective in improving participants' knowledge.

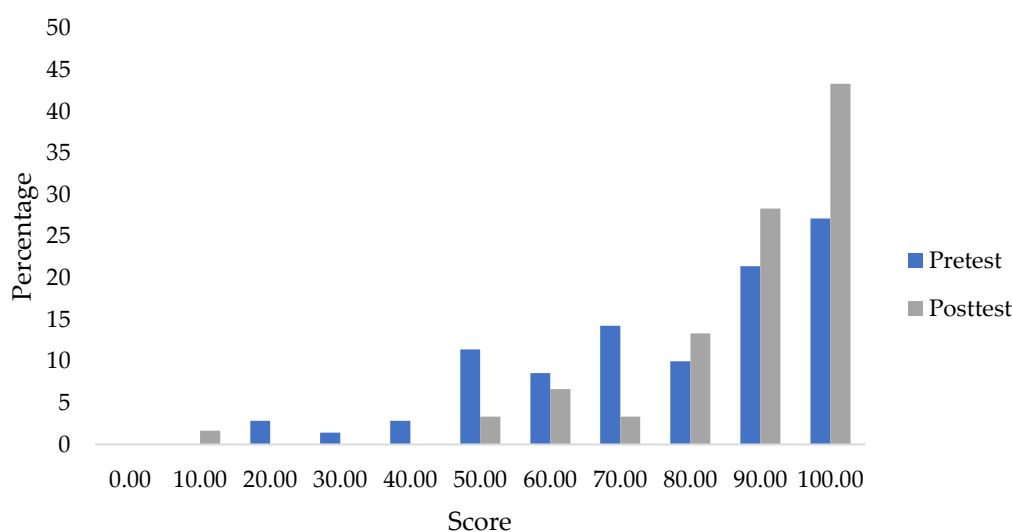


Figure 4. The Distribution of Scores Shifted from Pretest to Posttest

Furthermore, the proportion of low scores in the posttest was much lower than in the pretest. This finding indicates that the educational activity not only enhanced the knowledge of participants with a strong initial understanding but also helped participants with limited prior knowledge achieve a higher level of comprehension. Overall, the shift in the posttest score distribution from the middle to higher categories indicates that the educational intervention was effective in improving participants' knowledge of safe cosmetic and skincare use. This improvement is also consistent with the analysis of the percentage of correct answers for each question, which showed increased understanding across nearly all tested topics.

The findings of this study are consistent with several previous studies showing that health education interventions can significantly improve participants' knowledge. For example, a study by Varughese (2025) reported that a structured educational program on the harmful effects of cosmetic products among Adolescent girls significantly increased knowledge scores, with the mean pretest score of 26.05 increasing to 35.25 in the posttest ($p \leq 0.05$). These findings indicate that educational interventions are effective in improving participants' understanding of cosmetic safety and hazardous substances in cosmetic products (Varughese, 2025). Similar results were also reported in a community education program on drug and cosmetic safety conducted for Erawati (2024), where training on the safe use of medicines and cosmetic products improved participants' understanding, as demonstrated by the results of pretest and posttest assessments (Erawati et al., 2024). In addition, Putriana's (2024) findings support the effectiveness of educational interventions. The educational process increased participants' understanding by 92%, with the average score improving from 5.9 to 9.75. Furthermore, 96% of participants expressed a strong

interest and stated that the workshop helped reinforce the theoretical knowledge they had previously received, making the material easier to understand (Rachmawati et al., 2024).

3.3 Evaluation of Participant Satisfaction

Based on the satisfaction evaluation results presented in Figure 4, participants generally reported high satisfaction with the Campus Visit and workshop activities. The majority of responses across all seven items were concentrated in the categories of score 4 (satisfied) and 5 (very satisfied), indicating that participants generally found the program positive.

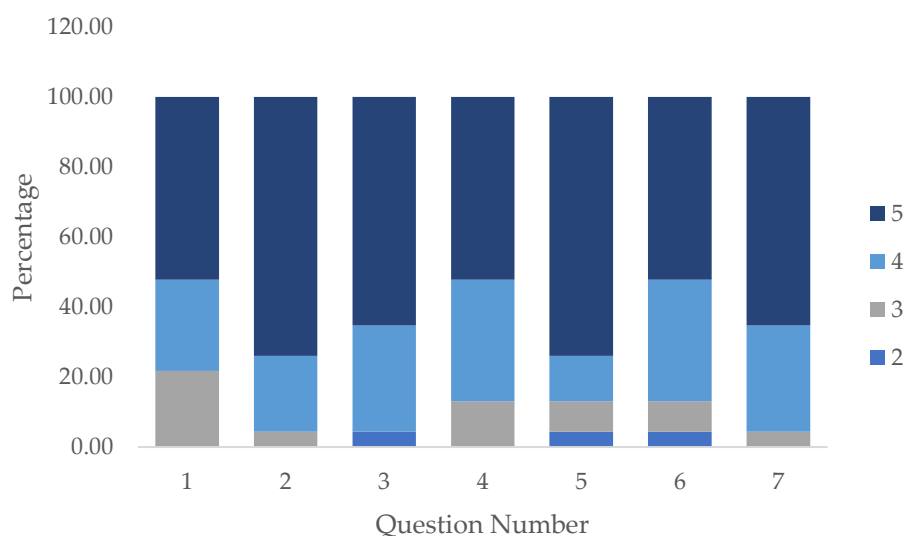


Figure 5. Satisfaction Evaluation Results

For question 1, which evaluated whether the Campus Visit activity was enjoyable, most participants scored 5, while the remaining participants scored 4, and a smaller proportion scored 3. This distribution indicates that the activity was generally perceived as engaging and enjoyable for the majority of participants.

For question 2, regarding the service provided by student mentors and the organizing team, the majority of participants again selected a score of 5, while a smaller proportion chose 4. Only a very small percentage gave lower ratings, suggesting that participants perceived the support and assistance provided during the activity as very satisfactory.

Question 3 assessed the adequacy of facilities provided to support the workshop activities. Most participants gave scores of 5 and 4, indicating that the facilities were generally considered adequate to support the learning process and practical activities carried out during the workshop.

For question 4, which measured overall satisfaction with the entire series of activities, responses showed a similar pattern: the majority of participants selected score 5, followed by score 4. This finding suggests that participants were highly satisfied with the program's overall organization and implementation.

Question 5 evaluated whether the activity topic was interesting. Most participants rated this item 5, indicating that the workshop topic successfully engaged participants' interest.

Similarly, question 6 assessed the relevance of the topic to participants' needs. The majority of responses again fell into the highest satisfaction category, suggesting that participants found the material relevant and useful for their knowledge and future learning.

Finally, question 7 examined whether participants' questions or concerns were adequately addressed during the activity. Most participants scored 5 and 4, indicating that the discussion and interaction during the activity were effective in addressing their questions.

Overall, the satisfaction results indicate that participants enjoyed the Campus Visit and workshop activities. The dominance of high satisfaction scores across all items suggests that the program was successful in providing an engaging learning experience, supported by adequate facilities, effective organization, relevant topics, and responsive interaction between participants and facilitators.

Responses to the open-ended questions provided additional insights into participants' interests and perceptions of the activity. Regarding topics participants would like to see in future activities, responses showed several recurring themes. Several participants expressed interest in topics related to cosmetics and skincare, including cosmetic formulation, trusted cosmetic brands, hair care, and skincare for specific conditions such as acne in oily skin. Some participants specifically mentioned an interest in learning how to make other skincare products, indicating a desire for more hands-on activities related to cosmetic formulation. In addition to cosmetics, several participants suggested topics related to biotechnology and biomedicine. This indicates that the workshop successfully stimulated curiosity about scientific fields beyond basic cosmetic knowledge. Other suggestions included food-related topics, such as food production and fermented foods, suggesting that participants are also interested in applied science topics that connect chemistry and biology with everyday life.

Feedback on participants' impressions and suggestions for the activity was predominantly positive. Many participants described the activity as enjoyable,

interesting, and beneficial. Several responses highlighted that the activity helped them learn new information, particularly regarding skincare, cosmetic safety, and how cosmetic products can be formulated. Some participants specifically mentioned that they were happy to learn about skincare and biotechnology, and that the activity increased their understanding of how skincare products can be made safely. Participants also expressed appreciation for the opportunity to learn practical knowledge that could be applied in daily life. For example, one participant noted that the workshop helped them understand how to make cosmetic products such as masks, which could be useful in the future. Others indicated that they enjoyed learning new things and found the experience engaging.

4. CONCLUSION

This study demonstrated that a community-based cosmetic safety education program combined with a hands-on workshop significantly improved adolescents' knowledge. The mean score increased from 72.71 ± 16.72 to 84.67 ± 10.45 , with a mean difference of 11.95 points, which was statistically significant ($t(9) = 4.31$, $p = 0.002$) and showed a large effect size (Cohen's $d = 1.36$). These findings confirm that the intervention effectively achieved its objective of improving knowledge on cosmetic safety. The study highlights the added value of integrating theoretical education with practical workshops, offering a more applied learning model compared to conventional approaches. This model can be implemented in schools and community settings to promote safe cosmetic use among adolescents. However, the absence of a control group and the limited sample from a single school restrict generalizability. Future studies should include larger populations and assess long-term behavioral outcomes.

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