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Digital Nudge Redesign in Online Transportation Apps to Promote Air Pollution Awareness Among Indonesian Youth

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Abstract

Responsible consumption is an important goal for maintaining resilience and sustainability. One of the most essential forms of consumption today is ride-hailing. However, responsible consumption behavior within Indonesia's ride-hailing sector—particularly in relation to air pollution concerns—and strategies to promote such behavior underexplored. This study redesigns the user interface of a ride-hailing application in Indonesia to incorporate digital nudges that promote responsible consumption. The study is conducted in four stages: developing research-based personas, generating redesign ideas with users and experts using the SCAMPER method, creating prototypes, and evaluating the designs. Air quality indicators were integrated into the interface to encourage users to select electric vehicle options, even when these options were slightly more expensive. The redesigned interface is evaluated through an A/B test involving 30 participants. The results showed that 33% of participants selected electric vehicles, compared to 0% in the original design. Interviews revealed that most participants overlooked the nudging elements because they were already highly accustomed to the existing booking workflow. Participants generally fell into three groups: those who ignored the nudges and focused solely on completing their booking, those who chose electric vehicles after seeing the pop-up notification, and those who noticed the nudges but rejected them, often citing disruption or price differences as reasons. Future research could explore ways to balance the promotion of sustainable choices with maintaining affordability in the consumption of digital services in Indonesia, and investigate the effectiveness of other forms of digital nudges.

Keywords: digital nudge, human-computer interaction, responsible consumption, ride-hailing, user experience

Abstrak

Konsumsi yang bertanggung jawab adalah tujuan penting untuk menjaga ketahanan dan keberlanjutan. Salah satu kebutuhan konsumsi utama saat ini adalah angkutan daring. Namun, perilaku konsumsi yang bertanggung jawab yang didasari oleh kepedulian terhadap pencemaran udara di sektor angkutan daring di Indonesia, serta strategi untuk mendorong masyarakat ke arah tersebut, masih belum dieksplorasi. Penelitian ini dilakukan untuk mendesain ulang antarmuka pengguna aplikasi angkutan daring di Indonesia agar mencakup dorongan digital untuk konsumsi yang bertanggung jawab. Studi ini dilakukan dalam empat tahap: merumuskan persona berbasis riset, menghasilkan ide desain ulang dengan pengguna dan pakar menggunakan SCAMPER, membuat prototipe, dan menguji desain. Berdasarkan proses ini, indikator kualitas udara diintegrasikan ke dalam antarmuka untuk mendorong pengguna memilih opsi kendaraan listrik meskipun biayanya sedikit lebih tinggi. Desain tersebut dievaluasi melalui pengujian A/B dengan melibatkan 30 responden. Hasil pengujian menunjukkan bahwa 33% partisipan memilih kendaraan listrik, sedangkan pada desain awal tidak ada partisipan yang memilih kendaraan listrik (0%). Wawancara mengungkapkan bahwa sebagian besar responden mengabaikan elemen *nudge* karena mereka sudah sangat terbiasa dengan alur pemesanan yang sudah ada. Responden umumnya terbagi menjadi tiga kelompok: mereka yang mengabaikan dorongan dan berfokus pada pemesanan, mereka yang memilih

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kendaraan listrik karena adanya notifikasi *pop-up*, dan mereka yang menyadari adanya dorongan tetapi menolaknya, sering kali dengan alasan gangguan atau perbedaan harga. Penelitian lanjutan berupa eksplorasi cara menyeimbangkan promosi pilihan berkelanjutan dengan menjaga keterjangkauan dalam konsumsi layanan digital di Indonesia, serta penerapan dorongan digital lainnya, dapat dilakukan.

Kata Kunci: dorongan digital, interaksi manusia-komputer, konsumsi yang bertanggung jawab, pengalaman pengguna, *ride-hailing*

INTRODUCTION

The Sustainable Development Goals are a set of global objectives initiated by the United Nations to achieve a more sustainable future. One of these goals emphasizes responsible consumption and production. Responsible consumption refers to human consumption behavior that fulfills needs while considering the sustainability of human life (Hermann 2023). One of the basic elements of these needs is human mobility. In Indonesia, the popularity of digital ride-hailing services, also known as online transportation, renders this sector a potential target for behavioral interventions aimed at encouraging people to adopt more responsible consumption habits (Asfarian 2024).

A digital nudge is a behavioral intervention strategy in the digital space, defined as the use of design elements in a user interface to steer users's behavior in a digital environment (Weinmann *et al.* 2016). It encourages customers to choose by influencing their rational considerations through intentional design interventions. Although it is commonly used to increase product sales (Jesse & Jannach 2021; Bergram *et al.* 2022), its potential also extends to promoting more sustainable choices within digital services, such as encouraging users to select electric vehicles instead of conventional ones in ride-hailing applications.

Currently, there is a lack of digital nudges related to responsible consumption in the ride-hailing sector in Indonesia (Asfarian *et al.* 2023, 2024). Prior studies indicate that the younger generation has not yet adopted digital nudges related to responsible consumption in ride-hailing applications. Hence, this study redesigns existing digital nudges to better align with the Indonesian context and culture. In this study, we apply the idea generation, redesign, and usability testing steps to restructure digital nudges to raise awareness of air pollution in digital ride-hailing services, using the SCAMPER framework.

METHODS

This research is conducted using idea generation, redesign, and usability testing. We utilized the SCAMPER framework (Serrat 2017), which consists of seven techniques: substituting (S), combining (C), adapting (A), modifying (M), repurposing (P), eliminating (E), and reversing (R) to generate ideas. This framework encourages divergent thinking, which refers to generating a wide variety of ideas and concepts (Ozyaprak 2016). All authors, comprising four lecturers, three students, and one practitioner, gathered to discuss redesigning ride-hailing apps to include responsible digital nudges. The four lecturers teach human-computer interaction or user experience design courses at different universities; the three students are from the computer science department and have passed the course; and one practitioner who works as a vice-president of design. All participants were users of online transportation services and not affiliated with them.

During the usability testing, 30 participants aged 19-22 - with the majority being in their early twenties - participated. The majority were female, with a smaller number of male participants. On a 1-5 Likert scale, participants generally reported moderate to high usage, with most using the apps several times per week. Commonly used features included ride-hailing, food delivery, and car services. Nearly all participants were willing to participate in the testing. Although only a small portion resided in South Jakarta, most had experience using ride-hailing services there.

Usability testing was conducted on the developed prototype using the Maze platform. This approach was adopted based on the view that usability is a determining factor in system success (Supriyatna 2018). Participants were assigned tasks to achieve specific goals and were

divided into two groups for A/B testing (Quin *et al.* 2024). Design A represented the redesigned prototype, while Design B corresponded to an existing ride-hailing app. Each Maze consisted of four blocks: (1) introduction and context; (2) participant information (name and age) for alignment with screener and Short UEQ data; (3) prototype testing, where participants booked a ride from Manggarai Station to M Bloc Space, a South Jakarta area where electric rides operate; and (4) completion of the Short UEQ via Google Form. The Short UEQ measures user experience quantitatively through eight items covering both hedonic and pragmatic aspects (Hinderks *et al.* 2018; Schrepp *et al.* 2014).

The interview questions focused on participants' previous experience and perceptions of the ride-hailing services. Questions included: (1) describing their experience using the prototype; (2) frequency of ride-hailing usage per week; (3) typical transaction amounts; (4) perceptions of air pollution; and (5) opinions on the use of electric vehicles in ride-hailing services. Additional questions focused on the redesigned prototype, including: (6) comparisons with commonly used ride-hailing applications; (7) identification of differences; (8) descriptions of observed differences; (9) perceived effectiveness of the nudging techniques; (10) suggestions for alternative approaches; (11) willingness to pay more for electric vehicle options; and (12) reasons for choosing either conventional or electric ride options within the prototype.

RESULTS AND DISCUSSION

Idea Generation Using SCAMPER

Table 1 summarizes the ideas generated during the brainstorming session focused on promoting responsible consumption in ride-hailing applications. The "Adapt" strategy involved collaborating with influencers to develop engaging environmental campaigns and integrating air quality data from the NAFAS app to encourage eco-friendly behavior.

Table 1 Collection of ideas generated from the brainstorming session

#	Idea	Description	Category
1	Create a campaign in collaboration with influencers that showcases the impact of environmental conservation activities to encourage users to activate responsible consumption features on the ride-hailing app (e.g., paying extra for tree planting: GoGreener, Carbon Fund; reducing plastic waste: no cutlery)	Adapt the campaign style used by influencers such as Pandawara, who effectively raise awareness (creating a FOMO effect through provocative, persuasive, and empathetic messaging) to encourage public participation (sharing information, volunteering for clean-up events) in environmental conservation efforts (beach or river cleaning).	Adapt
2	Provide rewards for using responsible consumption features to encourage users to activate these features more frequently	Combine the existing reward features in ride-hailing apps (such as priority services: GoClub) with responsible consumption features (GoGreener, Carbon Fund, no cutlery, and electric vehicles) to increase the adoption of responsible consumption features, which are currently perceived as additional costs that discourage activation.	Combine
3	Integrate air quality detection services from the NAFAS app, which displays poor air quality, to encourage users to activate eco-friendly features on the ride-hailing app (electric vehicles, GoGreener, Carbon Fund)	Adapt the air quality display from the NAFAS app to raise public awareness of air pollution issues, encouraging participation in reducing emissions by activating responsible consumption features (electric vehicles, GoGreener, Carbon Fund).	Adapt
4	Remove extra steps (such as a pop-up activation button) in the process of activating responsible consumption features like the Carbon Fund to make it easier for users to find and use these features, thereby increasing environmental awareness	Simplify access to information about responsible consumption features like the Carbon Fund by displaying them directly within the usual user flow, making them easier to discover during normal app use.	Eliminate
5	Display transparency regarding tree-planting funds collected from the Carbon Fund feature to build user trust in fund allocation, thereby increasing the usage frequency of the Carbon Fund feature	Modify the GoGreener and Carbon Fund interfaces by adding detailed transparency about how tree-planting funds are allocated to build trust and encourage more users to donate through the platform.	Modify

The Combine approach suggests linking existing reward systems with responsible consumption features to enhance user engagement. The "Eliminate" strategy aimed to simplify the activation process for features such as the Carbon Fund by removing unnecessary steps. The "Modify" approach sought to improve transparency in fund allocation for tree-planting initiatives to enhance user trust and participation.

Only one of the five SCAMPER ideas was selected for implementation: integrating an air quality detection service to encourage users to activate eco-friendly features within the ride-hailing application. This idea was selected because air pollution was a trending topic on social media. The objective was to raise awareness of responsible consumption through the use of electric vehicles, utilizing a prototype that could be developed without code implementation or direct collaboration with service providers.

Prototyping

The developed prototype was a medium-fidelity prototype, resembling the final digital product but offering limited interactivity within the tested scenarios. The interaction flow included booking a ride, selecting a mode of transportation, and integrating an air quality information feature adapted from the NAFAS app to raise user awareness of air pollution. The interface design adapted the visual style of the Gojek app to maintain consistency and familiarity (Figure 1).

The user flow presented in Figure 2 integrated digital nudge interventions throughout the ride-booking process. The first nudge appears during destination and pickup selection, where users receive a recommendation to choose the Electric option along with brief information on its benefits, such as zero emissions and lower noise levels. The second nudge is introduced before booking confirmation in the form of a pop-up displaying current air quality data, encouraging users to select eco-friendly vehicles. Finally, a post-trip nudge delivers an appreciation message reinforcing sustainable behavior. These strategically placed digital nudges are designed to raise awareness and motivate users to adopt responsible mobility choices through informative and persuasive in-app interactions.

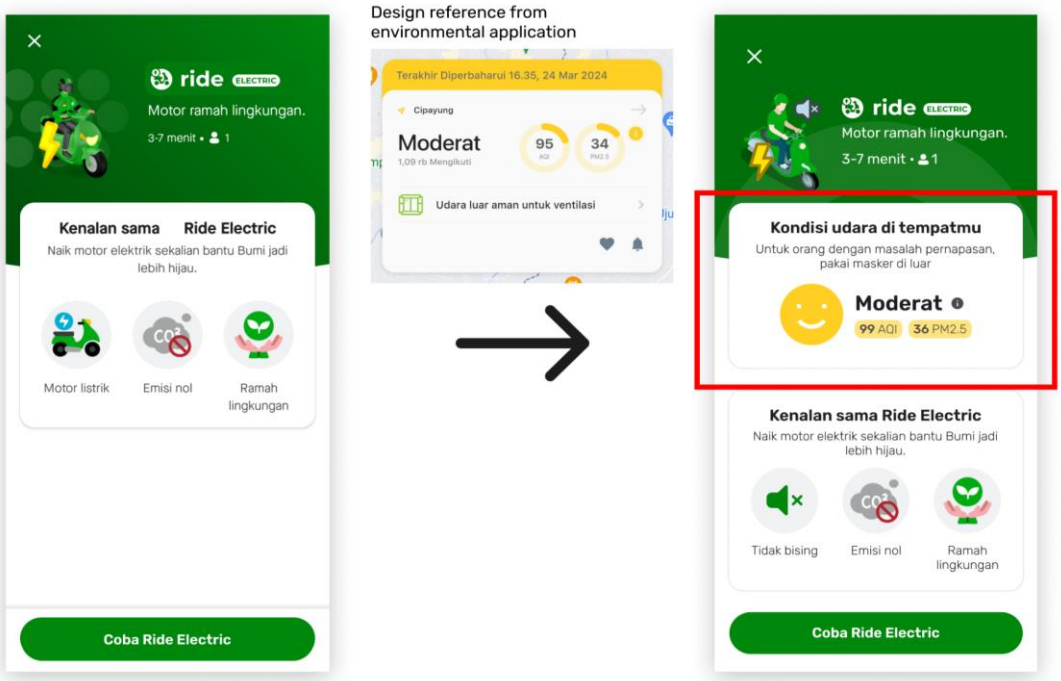

Figure 1 Comparison of the original design and the redesign of the electric vehicle option. We included air quality information in the design to inform customers before they take action

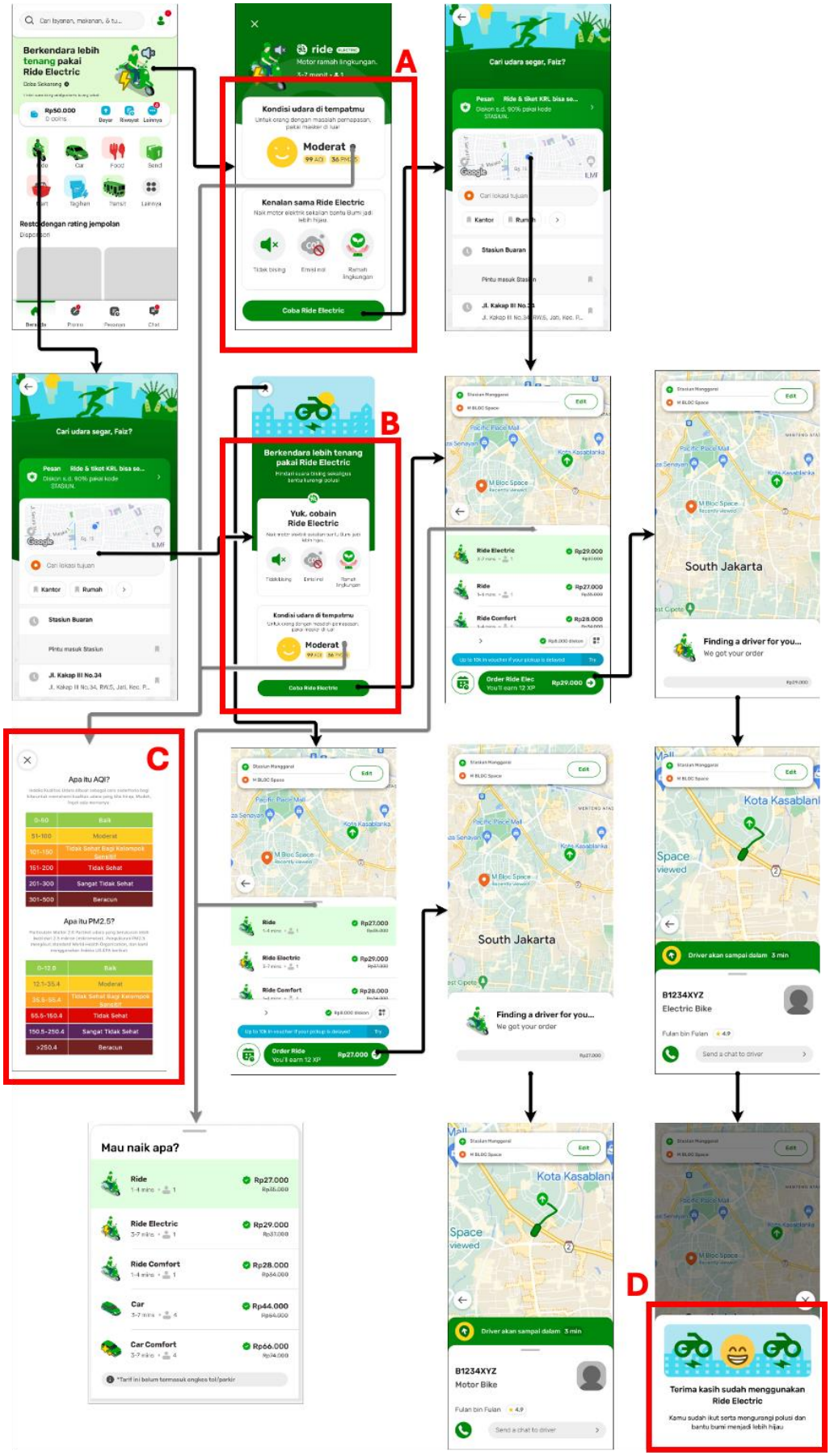

Figure 2 Screen flow of the redesigned ride-hailing service that includes the digital nudge. A: informing users about the air quality; B: nudge them to try electric cars; C: detailed information; and D: thanking them for their action for reengagement

Usability Testing

After developing the prototypes, a usability test was conducted to compare users' interaction between the original and redesigned versions, with a specific focus on the frequency of the GoRide Electric feature's usage. A total of 42 participants completed the screener form, but after data cleaning and eligibility screening, 30 valid respondents were included in the final analysis. After testing the prototype on the Maze platform, statistics were obtained, including direct success rates for the created path, misclick rate, average duration, and details related to the path chosen by respondents. The redesigned prototype achieved a direct success rate of 46.7%, with a misclick rate of 21.2% and an average task duration of 39.3 seconds. In contrast, the original prototype showed higher efficiency, with a direct success rate of 73.3%, a lower misclick rate of 13%, and a shorter average duration of 25.6 seconds. This result is attributed to the users's familiarity with the original design rather than the redesign. In the redesigned prototype, 33.3% of respondents chose the GoRide Electric option, while none did so in the original version. Although still a modest proportion, this result suggests that the nudging technique, which integrates air quality information, effectively encouraged more users to select the eco-friendly option.

The Short UEQ assessment further showed that the redesigned prototype achieved good user experience ratings, with average pragmatic and hedonic quality scores of 2.150 and 1.783, respectively, and an overall score of 1.967 on a scale from -3 to +3, indicating excellent quality. The original prototype also demonstrated very strong performance, with slightly higher averages of 2.467 for pragmatic quality, 1.683 for hedonic quality, and an overall score of 2.075 (Figure 3). Analysis of the eight Short UEQ items revealed minor variations between the two prototypes (Figure 4), with two indicators improving, four declining, and two remaining unchanged. Only the “hinder/support” indicator showed a notable decrease of 1.0 point, yet all indicators maintained scores above 0.8, reflecting a consistently positive user evaluation overall.

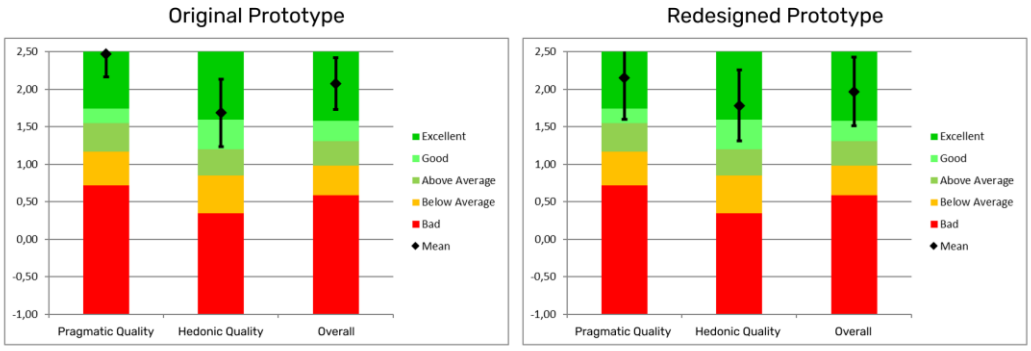

Figure 3 Comparison of UEQ of the original vs the redesign

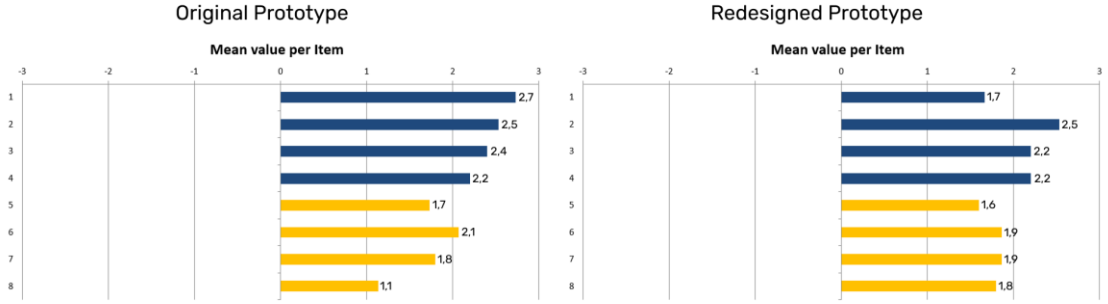

Figure 4 Comparison of UEQ per question score of the original vs the redesign

Out of 15 participants who were given the original design, none (0%) chose the electric option. Meanwhile, 5 out of 15 participants (33.3%) who were given the redesign chose the electric option, indicating that the redesign process successfully increased participant's preferences for sustainablechoices.

The interview findings show that respondents reacted differently to the digital nudges embedded in the redesigned prototype. Some participants followed the pop-up notification's suggestion and chose GoRide Electric because they were aware of its environmental benefits. One respondent said, "*The pop-up at the beginning immediately directed me to Electric. I can contribute to helping the environment. Riding an electric motorbike feels quiet, and I can even chat with the driver*" (P010). Another noted, "*The pop-up directed me right away. In regular applications, people don't really notice that the feature (Electric) exists. I actually want to help reduce pollution*" (P011). One respondent was drawn to Electric options because it felt new and visually appealing, saying, "*It looks new and interesting. The icon really catches the eye and makes it stand out from other modes*" (P001). However, some respondents admitted to skipping the *pop-up* without reading it, as it felt different from their usual booking process. One said, "*I usually just close the notification right away. It's a habit*" (P002), while another mentioned, "*I reflexively skip it; it doesn't seem that important*" (P009).

Regarding cost, several respondents were willing to pay slightly more for GoRide Electric, provided the price difference was reasonable. "*As long as the price is still reasonable*" (P001), "*I'm willing, but not if it's too much more expensive*" (P010), and "*If the price range isn't too far apart, I'd try the electric one*" (P008). Meanwhile, others preferred not to, prioritizing affordability: "*Honestly, I wouldn't*" (P004) and "*I prioritize the amount I spend, so I'd rather go with the regular Ride*" (P005).

Overall, respondents could be grouped into three types: (1) those who ignored the digital nudge and focused solely on booking, (2) those who noticed and followed the nudge, and (3) those who noticed it but decided not to act. These findings suggest that while digital nudges can effectively promote environmentally conscious decisions, their impact depends on user habits and perceived value, especially when they alter familiar booking processes or involve additional costs.

CONCLUSION

This research presented a redesigned prototype based on the selected SCAMPER idea, along with the results of usability tests, a Short UEQ analysis, and semi-structured interviews. Based on the results of the Short UEQ analysis, the pragmatic and hedonic aspects of both prototypes have shown excellent quality.Furthermore, based on the usability testing results, the redesigned prototype successfully increased the adoption rate of the responsible consumption feature to 33.3%. Future studies should explore how to balance promoting sustainable choices with maintaining affordability in Indonesian digital services consumption and other applications of digital nudges.

AUTHORS CONTRIBUTION

Faiz Byputra executed the redesign, performed the data analysis, wrote the initial report in Bahasa Indonesia, and participated in the brainstorming sessions. Dzakiyyah Hasbi Hutauruk, Salma Athoetani, and Raisya Shinta Siregar conducted the usability testing and participated in the brainstorming session. Dean Apriana Ramadhan evaluated the research methodology, co-authored the paper, and participated in the brainstorming session. Pristi Sukmasetya, Muhammad Farhad Idris, and Fitrah Satrya Fajar Kusumah contributed to idea generation and participated in the brainstorming session. Auzi Asfarian led the project, wrote the final publication, and was actively involved in the brainstorming process.

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