

Travel Bag with Detachable Ironing Sheet

Charlot L. Binzon, MTE¹, Vanessa Jane C. Lim, PhD²

¹*Master of Technology Student, Graduate School, University of Southern Mindanao - Kidapawan City Campus, Barangay Sudapin, Kidapawan City, North Cotabato, Philippines*

²*Professor, University of Southern Mindanao - Kidapawan City Campus, Barangay Sudapin, Kidapawan City, North Cotabato, Philippines*

Email of Corresponding Author: binzoncharlot3@gmail.com

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Abstract

This study developed and evaluated a Travel Bag with Detachable Ironing Sheet designed to integrate travel storage and portable garment care within a single multifunctional product. The study was anchored in functionalism, particularly the principle of form following function, and was further supported by human-factors and usability perspectives and an Input–Process–Output framework. A project study design was used for prototype development, while a quantitative research design was employed for evaluation. The developmental process included planning, pattern drafting, material selection, cutting, assembly, sewing, integration, testing, revision, and final evaluation. A researcher-developed questionnaire validated by three faculty experts was administered to 30 respondents composed of 15 teachers under Cotabato Foundation College of Science and Technology, and 15 random students from Custodial Care Program of Cotabato Foundation College of Science and Technology, Droluman, Arakan, Cotabato. Data were analyzed using frequency count, percentage distribution, and mode. The developed prototype successfully combined a foldable travel bag, detachable ironing surface, storage compartments, and a designated space for a portable electric iron. The product obtained a general mode of 5, interpreted as Highly Acceptable, for both design and usability. However, some design indicators concerning material suitability, bag size and shape, integration of the ironing sheet, and color combination received a mode of 4, indicating areas for further refinement. The study concluded that the prototype was functional, portable, convenient, and acceptable for its intended travel use. Further improvements in aesthetics, dimensions, compartment arrangement, folding mechanisms, attachment features, and durability-related components were recommended, together with broader user evaluation and exploration of commercialization opportunities. The study aligns primarily with SDG 9: Industry, Innovation and Infrastructure through applied product development and with SDG 12: Responsible Consumption and Production through its potential contribution to resource-conscious multifunctional design and responsible garment use. Its sustainability relevance lies in integrating multiple functions into one product system and supporting continued garment care, although the study did not establish direct environmental or life-cycle benefits.

Keywords: Detachable Ironing Sheet; Functionalism; Garment Care; Multifunctional Product; Product Design; Travel Bag; Usability

1. Introduction

The increasing demand for portable, multifunctional, and user-oriented consumer products has encouraged designers to integrate functions that were traditionally performed by separate devices. In the context of travel, luggage is expected not only to provide secure and organized storage but also to respond to practical concerns associated with mobility, limited space, convenience, and personal care. One persistent concern is garment presentation, particularly when travelers, students, and professionals need to maintain presentable clothing but have limited access to conventional ironing boards or appropriate ironing surfaces. The present study responds to this practical design problem through the development of a Travel Bag with Detachable Ironing Sheet, combining

storage and a portable garment-care surface within one product system. The study lies at the intersection of product design, textile technology, ergonomics, usability, modular design, and consumer-product innovation. Rather than treating the travel bag and ironing surface as unrelated objects, it explores whether the two functions can be integrated without unnecessarily increasing product complexity or compromising user convenience. This direction is consistent with contemporary human-factors research emphasizing that products should account for usability, safety, reliability, and operability throughout engineering design (Sun et al., 2019). ISO 9241-11:2018 further establishes usability as an outcome involving effectiveness, efficiency, and satisfaction within a specified context of use, making usability an appropriate basis for examining a multifunctional consumer product.

Innovative solutions that promote mobility and convenience have become increasingly relevant as consumers seek products that perform multiple functions while occupying less space. Norman (2013) asserts that consumers, particularly when traveling, favor products that simplify everyday activities and reduce unnecessary bulk. Developments in garment-care technology have similarly introduced travel-oriented solutions such as portable steamers, compact irons, wrinkle-resistant textiles, and alternative ironing surfaces (Lee & Chen, 2021). Despite such developments, travelers may still require an appropriate flat and heat-tolerant working surface before portable ironing equipment can be used effectively. The study identifies several limitations associated with existing portable garment-care solutions. Santos and Rivera (2020) noted concerns related to the rigidity and heat resistance of portable ironing mats, while Tan and Li (2022) emphasized the importance of ergonomic integration between travel accessories and luggage. These considerations support the need for a garment-care surface that is compact when stored yet functional when deployed. Accordingly, the proposed product integrates a detachable ironing sheet into a travel bag so that the ironing component can be removed when needed and stored with the bag afterward, consistent with the user-centered principles described by Cooper, Reimann, and Cronin (2014). More recent verified research provides stronger support for this design direction. Zhafira et al. (2018) demonstrated that ironing-product design can be systematically evaluated according to usefulness, ease of use, ease of learning, and user satisfaction. Chen and Wang (2019), meanwhile, addressed the conflict between ironing functionality and space consumption through a multifunctional ironing-table design, showing that ironing systems can be reconceptualized to achieve greater spatial efficiency. Their findings are particularly relevant because the present study applies the same broad design logic to a more mobile context: rather than accommodating ironing equipment within limited household space, the proposed product seeks to accommodate a usable ironing surface within a travel-storage system. The proposed innovation should therefore be understood not simply as a bag with an additional attachment but as a multifunctional product architecture in which storage, portability, organization, and garment care are intentionally coordinated. Peng et al. (2018) explained that product innovation becomes more responsive when product architecture is developed around user requirements and adaptable functions. Similarly, Shamsuzzoha et al. (2020) emphasized the value of modular product architecture for organizing interdependent product components while managing design complexity. These ideas strengthen the rationale for treating the detachable ironing sheet as a functional module rather than as an unrelated accessory.

A major theme emerging from the literature is the importance of material performance and thermal protection. Tan and Li (2022) emphasized heat-tolerant synthetic materials, whereas Santos and Rivera (2020) discussed the value of layered insulation in reducing heat transfer to supporting surfaces. Miller (2021) likewise discussed lightweight heat-resistant materials for portable household applications. These considerations are important because the ironing-sheet component requires a balance among flexibility, low weight, structural stability, and resistance to heat transfer. The study therefore uses layered textile construction as part of the prototype rather than relying on a conventional rigid ironing board. The study further identifies canvas, polyester, nylon, non-woven materials, and felt as relevant materials for bags and internal reinforcement because of their differing structural and functional properties (Luggage Factory, 2025; Feesly Bag, 2025). Polyester is specifically discussed for its durability and lightweight characteristics (Luggage Factory, 2025), while nylon is associated with strength and abrasion resistance (Lovrix, 2026). Non-woven and lining materials are discussed in relation to flexibility and structural support (INDA, 2020; Textile Exchange, 2021), while felt-type materials may contribute cushioning and insulation (Smith, 2019; Kothari, 2014). Earlier textile literature likewise associates fabric structure with mechanical and thermal behavior (Hearle, Grosberg, & Backer, 1969; Hu, 2008), including applications requiring reinforcement and thermal protection (Kadolph, 2010). Related combinations of material layers are discussed in the study as supporting usability and service life (Kadolph, 2010; Hu, 2008; Smith, 2019), while combinations of woven and non-woven components are presented as supporting multifunctionality (Hearle, Grosberg, & Backer, 1969; Textile Exchange, 2021; Hu, 2008; Kadolph, 2010). A second theme concerns compactness and multifunctionality. Cruz (2020) associated multipurpose and space-saving product configurations with practical consumer preferences, while Schneider (2022) emphasized detachable and modular features as mechanisms for increasing product adaptability. Chen, Wang, Nagai, and Zou (2018) similarly explored multifunctional ironing furniture intended to address space constraints. Contemporary verified evidence strengthens this theme: Chen and Wang (2019) demonstrated that multifunctionality and space intensification can be combined in ironing-product development, while modular-product research indicates that separately organized but interoperable components can increase adaptability and facilitate product evolution (Shamsuzzoha et al., 2020). A third theme concerns ergonomics and usability. Santos (2021) highlighted ergonomic considerations in relation to user convenience,

while Hsu and Lin (2020) associated multifunctional travel products with compactness and ease of use. Kurudirek (2025) discussed mobility-related design considerations in luggage, whereas Al-Shamrani and colleagues (2023) emphasized the relevance of posture and load distribution when bags are carried. Ulrich and Eppinger (2016) similarly connect product design with functionality, aesthetics, construction, and user experience. Norman (2013) and Hekkert and Desmet (2007) further emphasize the relationship between practical function, understandable design, and users' experience of products. Usability therefore represents more than aesthetic acceptability. The International Organization for Standardization (ISO 9241-11, 2018) relates usability to successful, efficient, and satisfactory goal achievement within a defined context. Donald Norman similarly emphasizes the importance of user-centered functioning, while Sanders and McCormick identify handling, weight distribution, and user comfort as important considerations in portable-product design. Current human-factors literature reinforces this position by emphasizing that usability and safety should be incorporated throughout engineering design rather than considered only after a prototype is completed (Sun et al., 2019). A fourth theme relates to garment care and clothing use. Sohyun Park et al. (2020) discussed factors contributing to garment wrinkling, while Laitala et al. (2020) linked clothing maintenance with garment condition and continued use. Liang et al. further discussed the use of heat and steam in improving garment appearance. These concepts support the practical role of a portable ironing surface, although the environmental consequences of garment care require a more careful interpretation than the study provides. Garment care itself consumes resources and energy; therefore, ironing should not automatically be described as environmentally sustainable. Recent literature provides a more defensible sustainability perspective. Wiedemann et al. (2021) demonstrated through life-cycle assessment that garment use and care practices can substantially influence environmental impacts, particularly when clothing lifespan and frequency of use are considered. Dao and Joyner Martinez (2024) similarly characterize sustainable clothing use through interrelated practices of wear, care, and repair. Thus, the sustainability significance of the proposed product is better framed around supporting appropriate garment care and continued garment use, rather than claiming that ironing itself reduces environmental impacts. The literature also identifies practical constraints affecting conventional garment-care systems. Morales and Zhang (2021) discussed the space requirements associated with full-sized ironing equipment, Villanueva (2022) addressed the storage limitations of traditional ironing boards, and Chen and Patel (2023) highlighted challenges in obtaining suitable ironing surfaces in temporary accommodations. Macaraeg and Teh (2024) associated compact living conditions with demand for multifunctional products. Similar problems were described by Ramirez and Choi (2021) in relation to accommodation facilities, Nguyen (2022) for mobile professionals, Mendoza and Li (2023) for students with limited luggage space, and Torres (2025) regarding limitations of portable ironing devices that still depend on a separate heat-resistant surface. Collectively, these themes indicate that a successful portable garment-care solution requires simultaneous attention to material selection, thermal protection, compactness, modularity, ergonomics, usability, storage efficiency, and user experience. The value of the Travel Bag with Detachable Ironing Sheet therefore lies in examining these considerations as an integrated product-design problem.

At the local level, the study is situated in the context of Cotabato Foundation College of Science and Technology in Doroluman, Arakan, Cotabato, where teachers and students constituted the intended evaluators of the prototype. The selection of these user groups provides a practical setting for examining a portable product potentially applicable to individuals who participate in academic, professional, and travel-related activities. The study evaluates a functional prototype rather than attempting to represent all Filipino travelers or consumers. This distinction is important because the study does not contain nationwide consumer data that would justify generalization to the entire Philippine population. At the national level, the study has potential relevance to technology education and locally developed consumer-product innovation. Rather than importing the assumptions of large-scale commercial luggage systems, the project demonstrates how locally available materials, fabrication processes, and user feedback may be combined to address an everyday design problem. Its primary national contribution is therefore developmental and educational: it provides an example of translating an identified user need into a designed, constructed, tested, revised, and evaluated prototype. At the global level, multifunctional and modular product development is increasingly associated with adaptability and more responsive product architectures. Research in modular product design shows that modularity can facilitate flexibility and user-oriented product configurations, although its sustainability benefits are not automatic. Amend et al. (2022), for example, found in another product domain that modularity can contribute to positive user experience and product-lifetime strategies when the modules and complementary user processes are properly designed. This reinforces the need to evaluate not merely whether a component is detachable, but whether detachment genuinely makes a product easier and more useful to operate.

The study is principally anchored in functionalism, particularly the principle that “form follows function.” From this perspective, the form of a product should serve its intended purpose, and individual components should contribute meaningfully to product functionality. Applied to the present study, the bag serves as the storage and transport system, while the detachable component serves as the ironing surface. The integration of these two functions reflects Sullivan's principle by allowing the physical configuration of the product to respond directly to requirements for portability, space efficiency, organization, and garment care. The theoretical basis can be strengthened through a human-factors and usability perspective. Sun et al. (2019) emphasized that engineering

design should systematically integrate human factors, including usability and safety. Likewise, the International Organization for Standardization (ISO 9241-11, 2018) provides a suitable evaluative basis because the product is intended to enable users to complete activities efficiently and satisfactorily in a particular context. These principles justify examining ease of carrying, attachment and detachment, organization, handling, comfort, and practicality rather than relying exclusively on appearance. Conceptually, the study follows an Input–Process–Output (IPO) structure. Inputs consist of ideas, references, materials, resources, prior arts, and equipment. The process involves planning, designing, innovating, testing, revising, and evaluating. The output is the developed Travel Bag with Detachable Ironing Sheet. This structure appropriately represents a developmental study because it links the resources and design requirements to an iterative fabrication process and a tangible prototype.

The literature reviewed for this study addresses several related problems, including ergonomic ironing stations, compact ironing equipment, portable garment care, luggage design, multifunctional products, modular product architecture, and clothing maintenance. However, these areas are generally treated separately. Among the literature retrieved for this revision, there remains limited direct empirical evidence examining a travel bag whose storage architecture incorporates a detachable ironing surface as a single integrated prototype, particularly within a Philippine educational and user-evaluation context. This gap provides a defensible rationale for the study. The novelty should not be claimed merely because portable irons, ironing sheets, or multifunctional bags already exist. Instead, the contribution lies in the specific functional integration and prototype evaluation: determining whether storage and portable garment-care functions can be combined in a configuration that users perceive as acceptable in terms of design and usability. The study should also avoid claims beyond its actual evidence. Its present evaluation focuses on design and usability acceptability, not laboratory certification of flame resistance, electrical safety, thermal conductivity, load capacity, waterproofing, or lifecycle environmental performance. Accordingly, terms such as “heat-resistant,” “safe,” “durable,” or “sustainable” should be presented as design intentions or material characteristics unless objective performance testing confirms them. This distinction strengthens the scientific credibility of the paper and prevents the conclusions from exceeding the methodology.

The study most naturally aligns with SDG 9 – Industry, Innovation and Infrastructure and SDG 12 – Responsible Consumption and Production. SDG 9 is relevant because the research applies design, fabrication, experimentation, and user evaluation to produce a functional consumer-product prototype. The United Nations identifies research, technological capability, and innovation as important components of progress under SDG 9. In this context, the study represents a small-scale form of applied product innovation in which an everyday problem is transformed into a testable technological solution. SDG 12 is relevant more cautiously. The multifunctional concept may support resource-conscious design when one coordinated product performs functions that would otherwise require several separate accessories. Research on modular design also indicates potential connections with product adaptability and product-lifetime strategies (Amend et al., 2022). In clothing consumption, continued use, appropriate care, and extended product lifetimes are increasingly recognized as components of sustainable consumption (Piippo et al., 2022; Dao & Joyner Martinez, 2024). However, the present research does not conduct a life-cycle assessment or energy analysis. Its SDG 12 contribution should therefore be described as a potential design contribution to resource efficiency and responsible product use, not as demonstrated environmental impact. The United Nations likewise frames SDG 12 around broader transformations toward resource-efficient consumption and production.

The study contributes to multidisciplinary sustainability by connecting technology, product design, textile application, human factors, consumer behavior, and practical mobility. From a technological perspective, it demonstrates how two established product functions can be reorganized into an integrated and potentially adaptable system. From an ergonomics perspective, it emphasizes portability, handling, attachment and detachment, organization, and user convenience. From a consumer-product perspective, it provides evidence on whether intended users accept the integration of travel storage and garment care. Its environmental relevance is more appropriately associated with resource-conscious product design and responsible garment use than with direct environmental savings. Research shows that garment lifespan, quality, care, and patterns of use are important dimensions of clothing sustainability (Wiedemann et al., 2021; Piippo et al., 2022; Dao & Joyner Martinez, 2024). Consequently, a well-designed garment-care accessory may have sustainability relevance when it supports continued clothing use; nevertheless, any claim of lower energy use, reduced emissions, reduced waste, or superior lifecycle performance would require additional empirical testing. The study also has educational and socio-economic relevance because prototype development allows technology students and local innovators to apply design thinking, material selection, fabrication, testing, revision, and user evaluation to a concrete problem. Its broader impact is therefore not solely the finished travel bag but the demonstration of a user-centered and evidence-based process for developing practical multifunctional products.

2. Material and methods

2.1 Research Design

The study used a project study design for the development of the Travel Bag with Detachable Ironing Sheet and a quantitative research design for its evaluation. The developmental component involved translating the conceptual design into a functional prototype through planning, pattern drafting, material selection, cutting, assembly, sewing, integration, testing, revision, and final evaluation. The product was designed to combine the functions of a conventional travel bag and a detachable ironing surface while emphasizing portability, usability, and convenience. The conceptual design specified the functional arrangement, dimensions, material placement, and layering of the travel bag and ironing sheet. The prototype incorporated heat-resistant and insulating materials, structural fabric, lining, zippers, compartments, handles, and straps. The materials were selected primarily based on their intended flexibility, durability, insulation, and heat-resistant properties. The ironing sheet consisted of layered materials intended to provide a usable ironing surface and thermal insulation, while the travel bag body was assembled with an inner lining, pockets, handles, straps, and reinforced stitching. The detachable ironing sheet was incorporated into the bag using attachment mechanisms that allowed the component to be deployed for ironing and stored when not in use. The finished prototype underwent inspection for alignment, construction quality, and usability. The initial prototype was subsequently tested and revised. During preliminary testing, inconsistencies in the intended dimensions affected the overall fit and functionality of the bag. A second prototype was therefore produced according to the specified measurements. The fit of the ironing sheet was also refined, and attachment features were improved to provide a more secure connection between the detachable component and the travel bag.

2.2 Locale of the Study

The study was designed and developed in Doroluman, Arakan, Cotabato, and the product evaluation was conducted at the Custodial Care Program of Cotabato Foundation College of Science and Technology, Doroluman, Arakan, Cotabato.

2.3 Respondents of the Study

The study involved 30 respondents, consisting of 15 teachers from Cotabato Foundation College of Science and Technology and 15 students or recipients from the Custodial Care Program of the same institution. The respondents evaluated the developed product based on its design and usability after observing its actual demonstration.

2.4 Sample and Sampling Procedure

A total sample of 30 respondents participated in the evaluation. The manuscript describes the selection procedure as a purposive random sampling approach, involving 15 teachers and 15 students or Custodial Care Program recipients. These respondents were selected to assess the developed prototype after it was presented and demonstrated to them.

2.5 Research Instrument

The study used a researcher-developed survey questionnaire designed to measure the acceptability of the Travel Bag with Detachable Ironing Sheet. The instrument was validated by three faculty experts from the University of Southern Mindanao–Kidapawan City Campus (USM-KCC) and underwent validity and reliability testing before its administration. The questionnaire used a five-point Likert scale, in which a rating of 5 represented *Highly Acceptable*, 4 represented *Acceptable*, 3 represented *Fairly Acceptable*, 2 represented *Slightly Acceptable*, and 1 represented *Not Acceptable*. The items were intended to assess respondents' perceptions of the product's design and usability following the actual demonstration of the prototype.

2.6 Data Gathering Procedure

Prior to data collection, the researcher prepared and submitted letters requesting permission to conduct the study to the Office of the College President, the Custodial Care Program Director, and the Office of the Director for Instruction of Cotabato Foundation College of Science and Technology. Upon approval, the developed Travel Bag with Detachable Ironing Sheet was presented and demonstrated to the selected teachers and Custodial Care Program students or recipients. After the demonstration, the respondents were given the evaluation questionnaire to assess the acceptability of the prototype. The completed questionnaires were collected by the researcher and forwarded for statistical processing and analysis.

2.7 Data Analysis Techniques

The collected data were analyzed using frequency count, percentage distribution, and mode. Frequency and percentage distribution were used to describe the distribution of respondents' ratings, while the mode identified the most frequently occurring response for each indicator. These descriptive statistical techniques were used to determine the level of acceptability of the Travel Bag with Detachable Ironing Sheet in terms of design and usability.

3. Results and Discussion

3.1 Development of the Travel Bag with Detachable Ironing Sheet

3.1.1 Product Design

The Travel Bag with Detachable Ironing Sheet was successfully designed according to its intended specifications. The developed design integrated a detachable ironing sheet into a lightweight, foldable, and portable travel bag. The detachable component could be attached and removed as needed, while a designated compartment accommodated the portable electric iron. The arrangement of the ironing sheet, compartments, and other components was intended to maximize accessibility and available storage space while maintaining the bag's portability and visual appeal. The resulting design demonstrated the feasibility of combining travel storage and a portable garment-care surface within one product. The integration of storage and garment-care functions reflects contemporary approaches to modular and adaptable product design. Peng et al. (2018) emphasized that product innovation becomes more responsive when product architecture is structured around changing user needs and adaptable functional modules. Similarly, Shamsuzzoha et al. (2020) explained that modular product architecture can help organize interdependent components while reducing unnecessary product-development complexity. In the present product, the detachable ironing sheet functions as a distinct but integrated module, allowing it to be deployed when required and stored as part of the travel bag when not in use. This design direction is also consistent with Chen and Wang (2019), who demonstrated that multifunctionality and space efficiency can be incorporated into ironing-related products to address limited space. More recent work by Monetti and Maffei (2024) further emphasizes that product architecture requires designers to balance functionality, user satisfaction, assembly requirements, and product complexity during the early stages of development. Thus, the value of the developed design lies not simply in adding another component to a travel bag but in coordinating two functional requirements within a compact product architecture. The detachable configuration also has implications for user experience. Although conducted in a different product context, Amend et al. (2022) found that appropriately designed modular products can contribute to positive user experiences when detachable or replaceable components are easy to understand and operate. This supports the present study's emphasis on convenient attachment and removal of the ironing sheet. However, modularity alone does not guarantee usability; the relationship among the detachable component, fastening mechanism, dimensions, and handling characteristics remains important to the effectiveness of the final product.

3.1.2 Prototype Construction

The prototype was successfully constructed by integrating the travel bag body, detachable ironing sheet, attachment system, reinforced stitching, storage compartments, and designated space for the portable electric iron. The completed product allowed the ironing sheet to be connected and detached from the bag and provided a compact configuration for carrying the ironing components together with other travel items. The prototype subsequently received favorable evaluations for both design and usability. The construction process demonstrated the importance of converting conceptual product requirements into a functional physical configuration. Zhafira et al. (2018) showed that ironing-related products can be designed and evaluated according to user-oriented characteristics such as comfort, security, attractiveness, sturdiness, durability, multifunctionality, and practicality. These considerations are relevant to the present prototype because its construction had to accommodate portability, storage, attachment and detachment, and ironing functionality within the same product. Sun et al. (2019) likewise emphasized that human factors and ergonomics should be considered throughout engineering design because usability, operability, safety, and reliability are closely related to the interaction between users and products. The revision of the initial prototype following dimensional and fitting problems also reflects the iterative nature of product development. Monetti and Maffei (2024) noted that decisions involving product architecture and assembly during conceptual development can influence subsequent product complexity and assemblability. Lim et al. (2024) similarly emphasized that dependencies among product components can lead to design iterations when interacting elements are not adequately resolved. In this study, correcting the dimensions and refining the ironing-sheet attachment mechanism represented necessary modifications to improve correspondence between the intended design and the constructed prototype. The construction strategy is also supported by the recent work of Leony et al. (2025), who developed an ergonomic and multifunctional ironing station by translating user requirements into product-design specifications through anthropometric and Quality Function Deployment approaches. Although their product and user context differed from the present study, their findings reinforce the importance of designing ironing-related facilities around user comfort, space constraints, and multifunctionality. The present prototype similarly attempted to respond to limited travel space by combining storage and ironing functions within a portable configuration.

3.2 Acceptability in Terms of Design

The Travel Bag with Detachable Ironing Sheet obtained a general mode of 5, interpreted as Highly Acceptable, for design. Six of the ten design indicators received a mode of 5, including the appealing and foldable design, placement of the portable electric iron, aesthetic contribution of the bag materials, arrangement of items, structural construction, and functionality for on-the-go ironing. The appealing and foldable design was rated Highly Acceptable by 57% of respondents, while 67% gave the highest rating to the placement of the portable electric

iron. Proper organization of items received 60% Highly Acceptable responses, and 63% gave the highest rating to the product's capability to support convenient ironing while traveling. Four design indicators obtained a mode of 4, interpreted as Acceptable. These included the suitability and apparent durability of the ironing-sheet materials, size and shape of the bag, integration of the ironing sheet with the overall design, and color combination. The material indicator received 53% Acceptable responses, while the size and shape received 50% Acceptable and 10% neutral responses. Integration of the ironing sheet received 50% Acceptable and 7% neutral responses, while the color combination received 60% Acceptable responses. Although the overall design was highly accepted, these indicators identify comparatively weaker aspects that may require additional refinement. The findings suggest that respondents generally approved of the functional organization, foldability, arrangement, and overall appearance of the product, while identifying areas for improvement in material selection, dimensions, integration, and aesthetics. The original discussion emphasizes that continuous product improvement is necessary to respond to changing user preferences and design requirements (Cross, 2011). According to Don Norman (2013), effective products should combine usability with visual and emotional appeal. Similarly, Nielsen Norman Group (2020) emphasizes the importance of product design to the overall user experience, particularly in enabling users to interact with a product easily and obtain its intended benefits. Recent research further supports this interpretation. Gao et al. (2021) argued that usability considerations should be incorporated during the early stages of innovative product development rather than treated as a secondary consideration after the product has been designed. Zhafira et al. (2018) likewise demonstrated that user evaluations of ironing-related products involve not only functionality but also attractiveness, comfort, practicality, and perceived durability. These perspectives help explain why the respondents could evaluate the prototype positively overall while still identifying weaknesses in particular design attributes. The findings concerning material suitability and apparent durability should also be interpreted as user perceptions rather than objective material-performance measurements. Aakko and Niinimäki (2021) explained that perceived product quality is multidimensional and is influenced by expectations, visual cues, and users' experiences with a product. Therefore, the favorable ratings regarding material quality and construction indicate positive perceived quality but do not independently establish laboratory-tested durability, thermal resistance, or long-term performance. This distinction provides a more scientifically appropriate interpretation of the respondents' evaluations. The relatively lower ratings for size, shape, attachment integration, and color combination also support further refinement of the prototype. Leony et al. (2025) emphasized the value of translating user requirements and ergonomic considerations into product dimensions and configurations, particularly when designing multifunctional ironing facilities. Similarly, Monetti and Maffei (2024) stressed that successful product architecture requires balancing functionality with user satisfaction and assembly considerations. These studies support further adjustment of the dimensions and integration mechanism without altering the central concept of the product.

3.3 Acceptability in Terms of Usability

The Travel Bag with Detachable Ironing Sheet obtained a general mode of 5, interpreted as Highly Acceptable, across all ten usability indicators. The proportion of respondents giving the highest rating ranged from 53% to 73%. Ease of attaching and detaching the ironing sheet and comfort during extended use each received 73% Highly Acceptable responses. Manageable weight and overall user-friendliness each received 70%, while ease of putting on and removing the ironing sheet received 67%. Ease of carrying received 63%, organization of clothing and accessories and enhancement of the travel experience each received 60%, and time-saving convenience received 53%. Only a small proportion of neutral responses appeared for ease of carrying, organization, and overall user-friendliness, and no responses were recorded in the two lowest acceptability categories. The results indicate that respondents generally perceived the prototype as convenient, manageable, easy to operate, and practical for travel. According to International Organization for Standardization (2018), usability concerns the extent to which specified users can achieve their intended goals with effectiveness, efficiency, and satisfaction. Nielsen Norman Group (2020) similarly identifies learnability, efficiency, memorability, error reduction, and satisfaction as important usability components. The favorable evaluations of attachment and detachment, portability, comfort, organization, and time-saving capability are consistent with these usability dimensions. Don Norman (2013) emphasizes that products should be intuitive and responsive to user needs, enabling tasks to be completed with minimal effort. The findings are further supported by Zhafira et al. (2018), whose evaluation of an innovative ironing-board design incorporated usefulness, ease of use, ease of learning, and user satisfaction as essential usability considerations. In the present study, respondents' favorable ratings for the detachable mechanism, carrying convenience, organization, and overall practicality indicate similar user-oriented qualities. Sun et al. (2019) further emphasized that human-factors considerations should address physical interaction, usability, operability, and user requirements throughout product development. These principles are particularly relevant to a portable product whose usability depends on carrying, handling, deploying, and storing several integrated components. The consistently high usability ratings further suggest that combining storage and ironing functions did not prevent respondents from perceiving the product as manageable and practical. Products that are intuitive and easy to operate can reduce user effort and improve overall experience, as discussed by Don Norman (2013). The reported time-saving capability also corresponds with Jakob Nielsen's (1994) usability theory, which emphasizes the ability of effective systems to help users accomplish tasks rapidly and with minimal effort. Likewise, the positive assessments of comfort and manageable weight are consistent with human-centered design

principles that adapt products to users' physical capabilities to reduce strain and support comfort (International Organization for Standardization 9241-11, 2018). The positive response to the detachable component also corresponds with broader modular-product research. Amend et al. (2022) found that modular product configurations can contribute to positive user experience when interaction with the modular components is understandable and convenient. Peng et al. (2018) similarly associated adaptable product architecture with the ability to respond more effectively to users' varying functional needs. These findings provide additional support for the present respondents' favorable evaluation of the detachable ironing sheet as a practical component of the overall travel-bag system.

4. Conclusion & Recommendations

The study successfully developed a Travel Bag with Detachable Ironing Sheet that integrates travel storage with a portable garment-care function. The completed prototype was designed to be lightweight, foldable, portable, and convenient to use, with a detachable ironing sheet that could be easily attached and removed without compromising the bag's primary storage function. The product received a Highly Acceptable evaluation in both design and usability, reflecting favorable perceptions of its portability, organization, ease of use, and practicality for travel. Overall, the findings indicate that the developed prototype achieved its intended purpose of combining storage and a portable ironing surface within a single multifunctional travel product.

Based on the respondents' evaluations, further product development should focus on refining the bag's aesthetic appeal, color combination, dimensions, compartment arrangement, folding mechanism, storage for the ironing component, product labeling, pockets, and use of heavy-duty zippers. Future studies may involve a larger and more diverse group of users to obtain broader feedback on the product's design and usability and may examine additional functional features that could improve user convenience and product performance. Further investigation may also explore the feasibility of commercialization, marketing, and eventual mass production of the Travel Bag with Detachable Ironing Sheet.

The study was limited to the development and user evaluation of a functional prototype intended primarily for simple garment-care activities during travel. The evaluation focused only on design and usability and involved 30 respondents composed of 15 teachers and 15 students from Cotabato Foundation College of Science and Technology in Dorooluman, Arakan, Cotabato. The findings were based on respondents' perceptions following the demonstration of the prototype and were analyzed using frequency count, percentage distribution, and mode. Accordingly, the results should be interpreted within the specific prototype, respondent group, study locale, and evaluation criteria used in the research and should not be considered evidence of laboratory-tested thermal performance, durability, safety, or large-scale commercial performance.

5. Compliance with ethical standards

The authors affirm that no conflicts of interest exist in relation to this study. The research involved the development and evaluation of the Travel Bag with Detachable Ironing Sheet and employed a non-invasive product demonstration and survey questionnaire among selected teachers and students of Cotabato Foundation College of Science and Technology. Prior to data gathering, permission to conduct the study was sought from the Office of the College President, the Custodial Care Program Director, and the Office of the Director for Instruction. Respondents evaluated the prototype in terms of design and usability after observing its actual demonstration, and their responses were analyzed in aggregate using descriptive statistical techniques. The study did not involve medical, psychological, or other invasive procedures and was limited to participants' assessment of the developed product. Participant information and responses were handled solely for research purposes, with due regard for privacy, confidentiality, voluntary participation, and responsible data management.

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