

Design of a modular, interactive and ergonomic workbench and chair for jewelry making

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ABSTRACT

Background and Objectives: The jewelry industry accounts for a large share of the income of the people and the government. Workbench and chair are the main tool for manufactures, designers, art students and repairmen in this field as a group of users for the efficiency of making jewelry. This research seeks to design a workbench and chair for making jewelry that, in addition to being modular, is also interactive and ergonomic.

Methods: This research is practical as well as qualitative-descriptive nature. It has used a survey method to collect data in which its most important tools in the practical were verbal-visual (questionnaire, interview) and non-verbal (observation). Its design method was the so-call Design up (Tarrahi Nameh in Persian) where has based on the interaction design and user-centered approach. One of the most useful techniques called hierarchical analysis process (AHP) has been employed to prioritize users and selected designs.

Results: The result of this research is a modular, interactive and ergonomic workbench and chair under the Mosavvab brand. Their users have the advantage of an independent design resulting from its modularity, benefit from usability as well as engagement user experience due to its interactivity and finally they satisfy from its safety and comfort due to its ergonomics.

Conclusion: This achievement eliminates tangible and intangible problems and not only provide users with personal satisfaction, but also reduce the need for many medical treatments. Six elements of usability such as effectiveness, efficiency, safety/comfort, utility, easy to learn and ease to memory, on the one hand would be brought. The goals of interaction design as visibility, feedback, constraints, consistency, affordance and engagement user experience, on the other hand, would be illustrated.

Keywords: Workbench and chair designing, Jewelry making, Modular, Ergonomics, Interaction design



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Extended Abstract

Background and Objectives

This research aimed to design workbench and chairs with modular, interactive, and ergonomic attributes for jewelry makers [1]. The jewelry industry constitutes a large share of the reserves and income of the people and the government. Many tools are needed for jewelry making. The main one is a workbench and chair, which should be easy to use. The users must use their idea in the design and pay attention to modularity and their physical and mental health. A study refers to the factors in product design such as modular design principles, cluster and user-centered production, and the application of psychological principles [2]. A study focused on a jewelry polishing workstation design and related production processes to reduce injuries caused by repetitive motion, improve users' productivity and efficiency, increase jewelry maker professional life, and reduce the training time required for new polishers.

Methods

Workbench and chair for jewelry making This research is applied and qualitative-descriptive in terms

of aim and nature, respectively. Data were collected using the survey method, with the two modes of verbal-visual (researcher-made questionnaire and interview) and non-verbal. The purpose and nature of this research are applied and qualitative-descriptive, respectively. To collect data, a survey method by making use of verbal-visual questionnaire made by researcher, as a most important tool of field-based, is employed. It benefits from analysis by relevant expert groups. Its design method was the so-call Design up (Tarrahi Nameh in Persian) where has based on the interaction design and user-centered approach and analytical hierarchy process (AHP) is used to evaluate the different stages of the project. The product design view, which includes the needs as well as subject view, has been realized in the form of library research. Field research has been followed by the method of users and product clinics, and in the design stage and branding, the research achievement has been obtained via battlefield of designs.



Figure 1. Designing steps

Workbench and chair for for jewelry making

In contemporary times, in addition to traditional and modern jewelry, wearable items have also expanded. Workbench and chairs are expanded to use in the jewelry-making industry. The products were measured artistically, in which inexpensive metals were used. Users of jewelry making are builders, designers, learners, students, and repairmen. In these groups, men and women are active. About five million people in Iran

are active in this industry, and fewer standards have been set for the convenience and efficiency of production in this industry.

Modular and interactive workbench and chair for Jewelry making

Modularity is modules, categories, and scales of their larger compositions and families that are separate but complement each other. Each module has a separate structure, the components of which are interdependent.

While units complement each other, they have the least interdependence and are flexible. The modular design can be implemented in different industries and provides capabilities, such as variety, upgrades, and repairs, customizing mass production, different layouts, lower costs for repair, faster production, and a better user experience [3]. Interaction design is retrieved from the interaction type between the user and the product that determines the method of use. It is a two-way connection, and the product provides the user command to use, so it is considered user-centered [5].

Ergonomics of workbench and chair for Jewelry making

The length and width of the jewelry-making

workbench for a user in the minimum dimensions should be at least about 70 by 90 cm, and its height should be 65 to 85 cm from the top edge of the workbench and 59 to 68 cm from the bottom edge (the height of fireproof stones affects the final height of the workbench). The workbench should have a place to install and use the sawhorse. The workbench must have a sawhorse. The workbench weight was at least 31 to 44 cm, and its depth was 36 to 47 cm. In a chair with a backrest, its length should be 10 to 24 cm, and its width should be 30 to 40 cm. The work should be 39 to 51 cm (Figure 2) [7].



Figure 2. Ergonomic dimensions of suitable furniture for making jewelry

Field research: users and workbench and chair clinics for making jewelry

To prioritize the degree of interaction of each of users with the product a survey was carried out on ten men and women who specialized in

Industrial design and jewelry was conducted in the following order based on the analytic hierarchy process method in the spring of 2020. The priority of each user was obtained (Figure 3b).



Figure 3. a) Users of furniture for making jewelry; b) Results of a pairwise survey of users' priority from the perspective of industrial designers and jewelry experts

Due to the importance of understanding users' opinions for product design, a questionnaire was developed containing twelve interaction elements. The questionnaire was distributed among 1

builders, 4 designers, 4 teachers, and art seekers, and 2 repairmen using the field method (verbal and non-verbal) in the spring of 2020. The results have been shown in Figure 4.

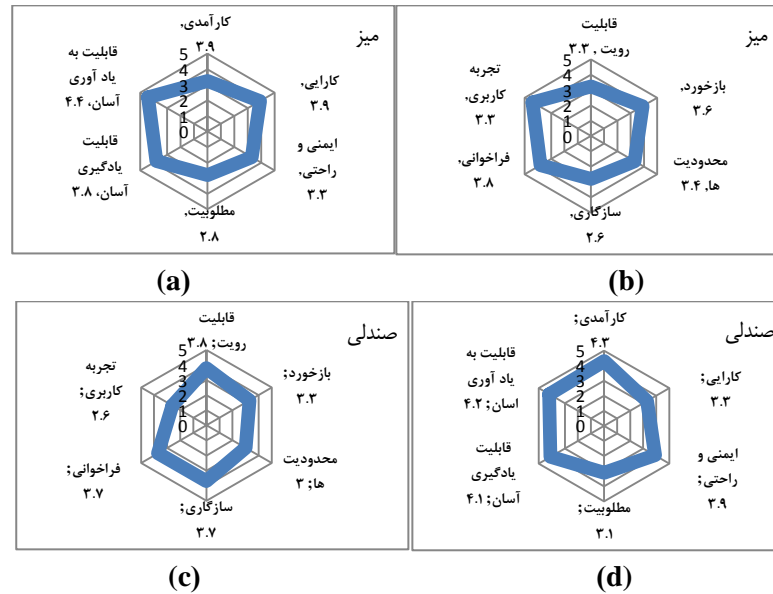


Figure 4. (a-t). The results of user surveys in the field research on the twelve features of interaction with the with the workbench and chair for making jewelry

The design requirements were developed according to the results of field research and their combination

with design criteria obtained from library research (Figure 5).



Figure 5. Design requirements of furniture for jewelry making

Design, scheme, and achievement: approved furniture for jewelry Results

Design and ideation were conducted according to the design requirement, minimum viable conceptual the approved word was selected for designing the

scenario (MVCS), and interaction of users and product (Figure 6a). Due to the user and product interaction and its modularity, the initial words of the workbench, chair, and modular were used, and logo of a workbench and chair for jewelry making.

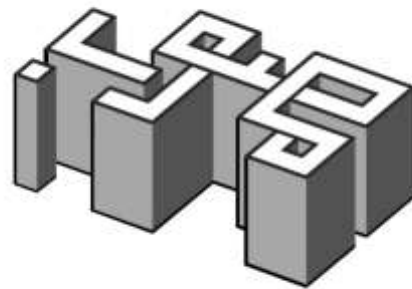


Figure 6. a) Minimum viable conceptual scenario; b) Approved logo of jewelry making workbench and chair

Three designs were selected based on modularity, interactivity, and static and dynamic anthropometric means by categorizing the three ideas (Figure 7). To coordinate designs and items in design requirements, a questionnaire about the user's interactions with the furniture in Press Line was

distributed among four professional groups, including 10 makers, 4 designers, 4 teachers and students, and 2 repairmen in the summer of 2020. The mean of the responses was calculated for the three workbench and chair models (Figure 7).

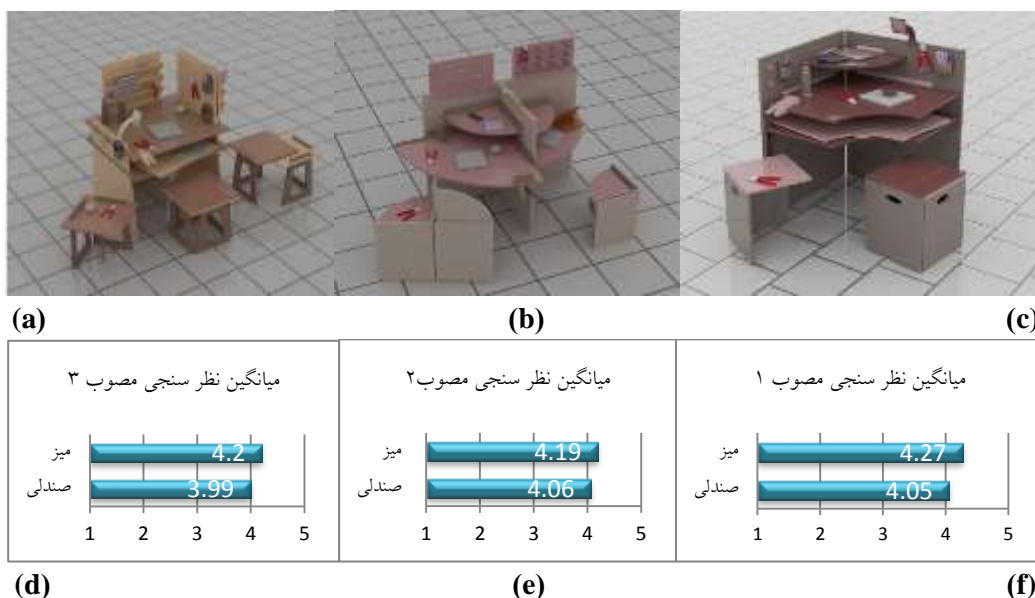


Figure 7. A to C) The first selected projects (Mosavvad avval), third (Mosavvabe dovvom) and third (Mosavvabe sevom) and their opinion polls

Mosavvab jewelry making modular and interactive workbench and chair

The scenario of using the approved jewelry-making furniture has been shown in Figure 8a. The user installs the product to learn and remember easily using the catalog. The user must first sit on a chair and adjust the ambient table light. If a study lamp is attached to the added classes,

it should be adjusted to use the workbench surface easier for sawing, welding, and other tasks. In the next step, additional wall divisions are used to complete the construction work. Interactor transfer of information between the user and the product is important in interaction design which is conducted in four ways, passive, active, interactive, and supra active (Figure 8b) [8].

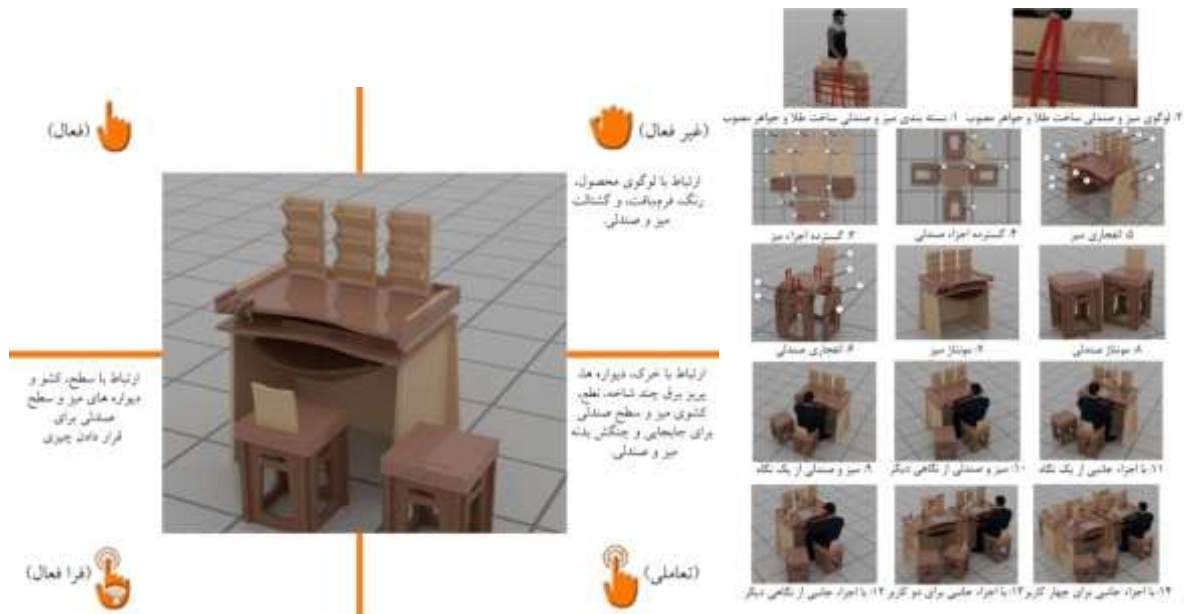


Figure 8. a) Approved workbench and chair; b) interactive of approved workbench and chair

Interactive features of approved jewelry making workbench and chair

Since the cover of the surfaces and parts of the workbench and chairs will have a smooth texture, it is tried to cover the workbench with formaldehyde-

free coatings. One hundred lux light is the best light recommended for jewelry making. The physical, technical, and engineering characteristics of the workbench and chair components have been shown in Figure 9 and illustrated in Figure 10, Figure 11, and Figure 12.

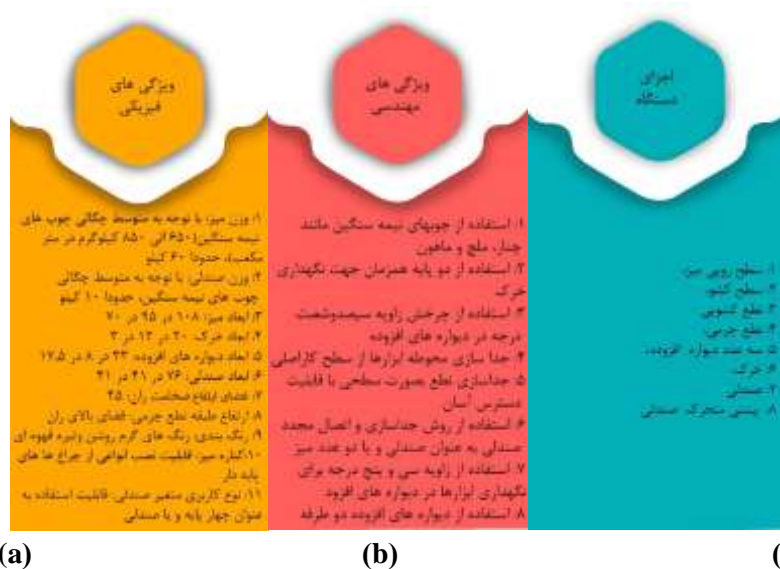


Figure 9. a-c) Physical, technical, and engineering characteristics and the component of approved workbench and chair

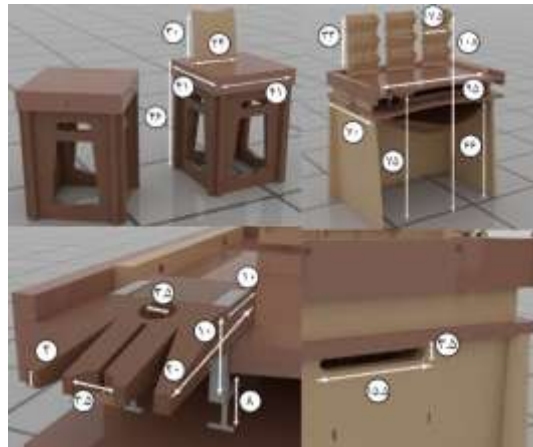


Figure 10. Physical characteristics of the approved workbench, chair, and sawhorse (sizes are in centimeters)

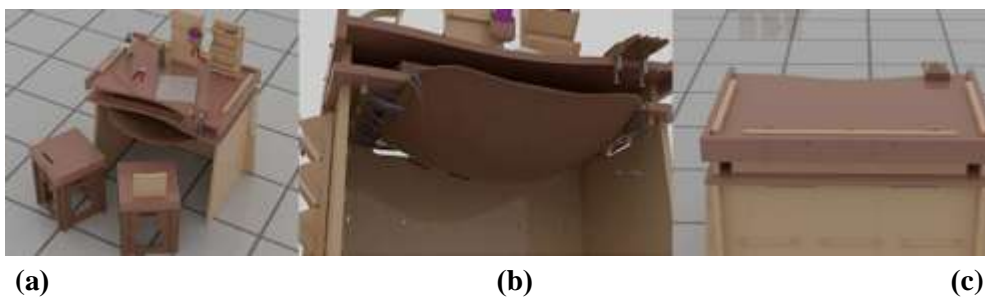


Figure 11. a-c) Technical and engineering characteristics of the approved workbench, chairs, and sawhorse

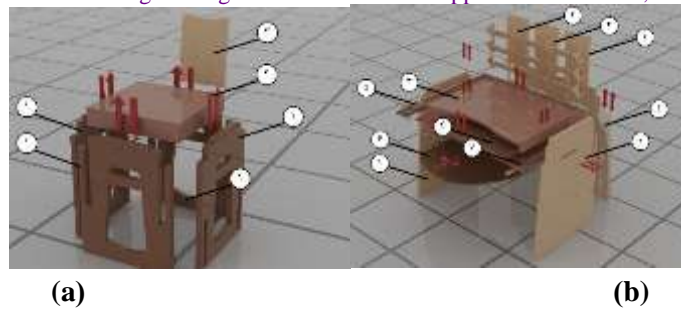


Figure 12. a & b) Explosive components and facades of approved workbench and chairs

Ergonomic features of approved jewellery making workbench and chair

The user has easy access to the added 33 by 17.5 cm upper parts of the workbench with rotation capability, at the level of 70 by 95 cm. The design has been conducted according to the average fiftieth

percentile of men and women in this industry at a maximum height of 33 cm. The access limit has been shown in Figure 13a. When the users make jewellery, subconsciously bends their body. The front of the workbench has a 25-degree curvature, which has been shown in Figure 13b.

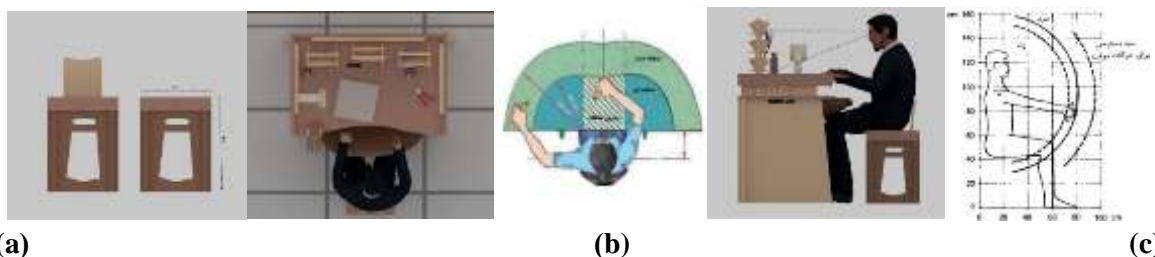


Figure 13. a) Body access limit in sitting position for temporary movements in the approved workbench and chair; b) Posture; c) Approved light chair with two functions

Aesthetic features of approved jewelry making workbench and chair

In the design of the workbench body, based on the principle of similarity, the similar size of the parts makes them look integrated. The added walls have found a strong interaction according to the principle of proximity. Although the lines of the walls are not continuous and are fragmented, they seem to be integrated according to the closure. Based on the principle of parallelism, the visual structure of the

workbench is aligned and will be accepted as a unit (Figure 14). The use of Gestalt in the chair is such that using the principle of common fate in the structure of the chair, all the bases, which are also considered as a kind of wall, have created a set in one direction as a unit with a common function that is easily visible to the user and can be used without confusion. The color of the workbench and chairs was dark and light brown. The texture of the workbench and chairs has been polished.



Figure 14. Approved workbench and chairs from an aesthetic point of view

Conclusion

In this research, the generalities related to workbench and chairs were discussed and expressed through library research and research background. The research method, users' and product clinics, and designing questionnaires and results have been provided. The ideation, scenarios, and selected designs have been described in the scheme under the workbench title and chairs for making jewelry based on the modular, interactive, and ergonomic principles with the approved brand name. The selected scheme was described with physical and technical, functional, ergonomic, and aesthetic details. The approved achievement solves many invisibles but effective problems, ensures a person's

physical safety, enhances the usefulness and user experience, and provides user satisfaction. It will improve the quality of the product and reduce the need for many medical treatments for the user.

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Conflict of interest

No conflict of interest has been reported by the authors.

References

1. Taherian Ojaroud R. Design of jewelry making modular and interactive workbench, Master thesis. Science and Research branch. Islamic Azad University. Tehran. Iran. 2020.
2. Faraji A, Behzadi M. Triple modular design, mass production and personalization of industrial products. Journal of Fine Arts - Visual Arts. 2012; 3: 67-78.

3. Charles L. Mauro CL, Fisher E, Korpan D, P. Medrano A. Ergonomic redesign of a Traditional Jewelry-Polishing Workstation. Ergonomics in design The Quarterly of Human Factors Applications. 2015; 4-12.
4. Faraji A. Design up, Scientific Conference to Celebrate Research Week of Isfahan University of Arts, Iran. 2010, Dec.

5. Rogers, Y, Preece J, Sharp H. Interaction design beyond human-computer interaction, 5th Edition. John Wiley & Sons Inc. 2019.
6. Saaty TL. The analytic hierarchy process. John Wiley & Sons. New York. 1980.
7. Nadafi K, Junidi A, Mazlumi A, Sadeghi F, Fathollahi, I, A guide to Static anthropometric indices of Iranian workers, Center for Environmental and Occupational Health. 2020.
8. Faraji A. User-Centered Design Course, Department of Industrial Design, University of Tehran, 1397.