Electronic Jewellery: The Coalescing of Electronic Devices and Contemporary Jewellery

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Abstract. This paper discusses the innovative combinations of electronic devices and jewellery as a new approach in electronic jewellery. Jewellery is an expression of the human need to look stylish and appear attractive. There are plenty of jewellery designs available in the market namely necklaces, rings, bracelets, and earrings. At the same time, there are a variety of electronic devices that have become attractive to consumers. While an electronic device is used in the present age to assist people in communication, entertainment, and work operation, jewellery is generally known and worn only for the purpose of fashion regardless of age. Hence, researchers are looking forward to changing the way people perceive its use and the styling of jewellery. In this study, researchers discuss the potential of varying the styling of jewellery that have been combined with electronic devices. As jewellery makers and designers, researchers demonstrate a different approach to the development of jewellery making combined with electronic objects. Feedbacks retrieved from the questionnaires were categorized into two (2) main sections: Section A: Level of evaluation criteria on designs and Section B: Level of evaluation on the products. This study can widen the significance and style of wearable electronic jewellery based on design and product.

Keywords: potential, electronic jewellery, electronic device

1 Background of the study

This research is about creating electronic jewellery design focusing on the innovation of electronic technology devices. Today, technologies have already impacted the world of jewellery at a surprising and rapidly increasing rate. The potential of integrating technology into jewellery practices has been continuously explored since the earliest published examples from the 90s such as two sentimental rings made by Nicole Gratiot Stober in 1994 (Silina & Haddadi, 2015). The ring that contains a small light that turns on when two lovers touch their hands may not sound advanced, but it managed to give more meaning to the jewellery field and opened new possibilities to the combination of technology and jewellery.

Since then, it is fair to say that more and more designers have started to depend more on technology as they use nifty software and computer-aided designs to meet customers' needs.

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This position is also taken by Koulidou (2018) as she cites the IBM set, a prototype of a cell phone that consists of several jewellery pieces, as one of the examples of incorporation of technology and jewellery. This IBM set has a necklace embedded with a microphone, a 'magic decoder ring' equipped with LED to indicate an incoming call as well as a bracelet equipped with a video graphics array (VGA) which functions as a caller identifier (Koulidou, 2018).

This shows that the development of jewellery making has continued to rise with the production of jewellery that has multiple functions which is usually known as multifunctional jewellery. Multifunctional jewellery can be referred to as a device that consists of a variety of different devices that function differently. Multifunction in its most basic sense refers to at least two different functions with one function as its base and one or more functions as added capabilities.

The main idea behind the IBM set is to highlight technology as part of people's daily life with the help of pieces of jewellery connected with wireless networking systems. As this field continues to be explored, it is worth noting the emergence of the term digital jewellery. According to Jain (2015, as cited in Koulidou, 2018, p. 2), digital jewellery can be referred to as "fashion jewellery that allows you to communicate by ways of email, voicemail, and voice communication or wearable ID devices that contain personal information like passwords, identification, and account information." From this alone, it can be seen that this incorporation of technology and jewellery can be brought to another level, making people's life easier and daily activities more exciting. It paves the way for more digital jewellery to be produced for targeted audiences.

In regard to the above examples, the researchers have decided to combine an electronic device with jewellery. This is pertinent as at the present time, there are a variety of electronic devices which can easily attract consumers, especially students and working people. In addition to this, there are a lot of jewellery designs available in the market like necklaces, rings, bracelets, and earrings. Thus, the researchers attempt to identify and analyse an appropriate electronic device that has the potential to be combined with jewellery.

2 Problem statement

Basically, jewellery is an expression of the human need to adorn the body which has very little practical purpose (Rajili et al., 2015). Technology, on the other hand, plays an important role in human life and assists people in various fields. Babbar (2002) suggested that consumers expect products to be functioning at its best where they possess high level of usability. However, these developments are emerging outside the field of contemporary jewellery, and electronic jewellery is significantly under-explored (Koulidou, 2018). The advancement of technology in the digital age is one of the ways that can be used in developing jewellery productions. In this study, by using the advantages in electronic devices, researchers have demonstrated a different approach to the development of electronic objects from the perspective of a jeweler. From this innovation in jewellery making, the boundaries of jewellery will be extended as it ensures that the function of jewellery does not limit to only fashion or body accessories.

3 Aim and Objectives

The aim of this research is to explore the potential integration of electronic technology devicesin contemporary jewellery.

The objectives are to:

1. Examine the potential combination of electronic devices with forthe contemporary jewellery manufacture of electronic jewellery.
2. Identify the level of design evaluation criteria in the creation of electronic jewellery.
3. Identify the level of product evaluation criteria in the creation of electronic jewellery.

4 Literature review

4.1 Jewellery

Jewellery is a personal adornment such as a necklace, ring, earring, pendant, and bracelet, made from a variety of materials such as gemstones and precious metals. According toRajili et al. (2015), this ornamental object is designed to enhance the look of the wearer, and astime passes; its design has been developed, resulting in it to have a discipline of its own. Although during earlier times, jewellery was created for practical uses such as to show wealth, power, and religions, it is safe to say that its importance has been increased and the practice of it has been modified to fit the present times (Ray, 2019). Today, there are various types, materials, and designs incorporated in the making of jewellery. Even though high-quality ones are made from gemstones and precious metals, there is also a growing demand for art jewellerywhere both design and creativity are priced above material value.

It is essential to draw attention to the link between contemporary jewellery and the body before considering the nature of wearable electronic objects. Jewellery has been made to be put on nearly every part of the body, from hairpins to toe rings and up to the head in order to give better appearance and beautify the wearer (Rajili et al., 2015). It can therefore be said that jewellery is ultimately linked to the body. However, it is significant to note that in contemporary jewellery, the relationship is not dependent on a jewellery object being worn, or even being wearable.

4.2 Contemporary Jewellery

The development of jewellery can be seen from time immemorial. Bernabei (as cited in Takamitsu, 2016) stated that the emergence of jewellery was due to the desire of the ancient people to adorn their body, but considering how society has evolved, the understanding of jewellery is not only limited to fashion and symbol of status anymore. It can also be seen nowadays that a variety of jewellery designs have been produced, which at the same time indicates that the materials used in the making of jewellery have also been actively explored, bringing into light the concept of contemporary jewellery.

Regarding this, Arroyo (as cited in Takamitsu, 2016) defined contemporary jewellery as a discipline that seeks to extend the notions of jewellery by renewing, reinventing, and experimenting with new materials, techniques, and designs of it. It is also worth mentioning that the incorporation of various materials has added a functional value to contemporary jewellery (Arumsari, 2015). Stasiewicz (as cited in Nur Syafinaz et al., 2019) asserted that:

> Contemporary Jewelry, also known as Modernist Jewelry, has gone far beyond the craft, becoming virtually another discipline of art, a tool to express the author's statement. Contemporary Jewelry also the phenomenon of costume jewellery appeared, mass-produced, cheap, made from new materials and closely associated with the wave of pop art.

4.3 Electronic Jewellery (electronic devices + jewellery)

The trend of wearing devices as fashion accessories seems to be catching up. Presently, more and more devices can be doubled as trendy pieces of jewellery.

Figure 1. USB Jewel Watch Necklace Flash Drive

Figure 1 shows the USB Jewel Watch Necklace Flash Drive which is the latest piece of device jewellery to hit the markets. It is a necklace as well as a flash drive and a timepiece. A 3 in 1 item, the USB connector is hidden smartly behind the tiny watch. The smart timepiece and USB hang on a beautiful silver looking chain ("USB Jewel Watch," n.d.).

Figure 2. The Heart Wave and the Heartbeat pendant

Figure 2 shows the Heart Wave and the Heartbeat pendant that offer high-tech style without sacrificing function - the drive itself is cleverly hidden in what looks like a regular necklace at first glance. Notice that the necklace mounting is on the side for practical reasons as the heart locket opens at the vertical center.

Figure 3. The Novero Bluetooth Earpiece Necklace.

Figure 3 shows the Novero Bluetooth Earpiece Necklace. Novero is a tech-company that specializes in accessories - Bluetooth headsets, smartphone stands and high-tech jewellery. This over-the-top specialty piece from Novero is a pearl necklace with a pendant that hides an earpiece and works as a Bluetooth device (Segan, 2010).

4.4 Electronic Devices

The use of electronic devices has soared to fame since technological advancement began. Nowadays, it is generally admitted that electronic devices have played a significant role in delivering consumers with compact entertainment and unparalleled communication, particularly those devices that can be brought and carried everywhere. The development has resulted in the creation of more tools and advanced equipment, affecting people's lives in a positive way as they make work easier (Chitamba, 2014). Different types of latest gadgets can be found in the market. As the world continues to digitize, it is no surprise that there has been a growing interest in exploring the potential of incorporating electronic devices even into jewellery (Koulidou, 2018).

Most electronic devices that have eventually become part of people's lives today comprise mobile telephones, portable media players, digital cameras, and camcorders. A mobile telephone can be considered the most important among other devices as it serves as an effective replacement for fixed-line telephones and is primarily used for communicating. It is not an understatement to say that mobile phones have become a necessity in life for it assists in

bringing people together through its interconnected networks and extended arrays of data (Chitamba, 2014). Meanwhile, a portable media player enables people to listen to music, watch videos, or even view digital images. Digital cameras make it possible for people to take pictures in the form of digital images as well as store and organize them. People need electronic devices to do business, to have some recreation and help them get through their daily lives. They have made life a lot easier for businessmen, corporate executives, and entrepreneurs as they can monitor their business and work while they are away. It is fair to say that aside from making people's tasks easier to be done and managed, electronic devices have helped us to continue exploring new possibilities and push our boundaries (Chitamba, 2014).

4.5 The Combination Electronic Devices and Other Functions

The combination of the right material in the production of the product is very significant. Apart from the combination of materials in the production, the integration of other functions in the production of electronic devices has also been practiced.

Figure 4. Examples of the combination between electronic devices and other functions

Figure 5. Show Calvin Klein USB Memory Frame

Figure 5 shows Calvin Klein USB Memory Frame. The Calvin Klein USB Sunglasses features a hidden USB drive in one of the arms of the sunglasses in which the arm can be detached and then plugged into the PC or Mac to retrieve data (Clarke, 2012).

5 Methodology

5.1 Double Diamond Model in Jewellery

Double Diamond is a model created by the Design Council, a British organization in 2005 (Gustafsson, 2019). It provides a graphic illustration of the design process thus fits to be applied in this study.

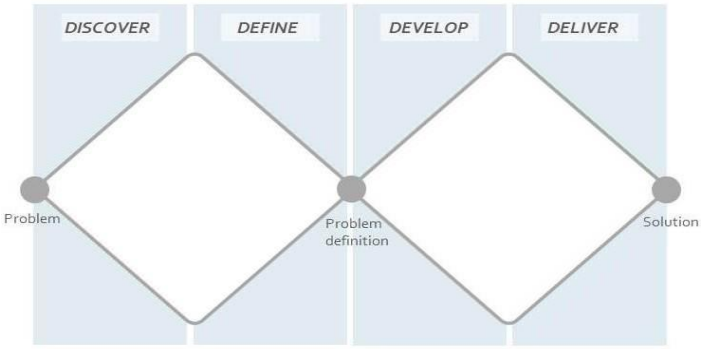

Figure 6. Double Diamond Model

According to Lipiec (2019), each design process has four phases which are:
1) Discover - identify, research, and understand the problem,
2) Define - limit and define the problem to besolved,
3) Develop - focus and develop the idea, and
4) Deliver - iteration and testing, preparingthe concept for production and launching.

5.2 Design and Making Process

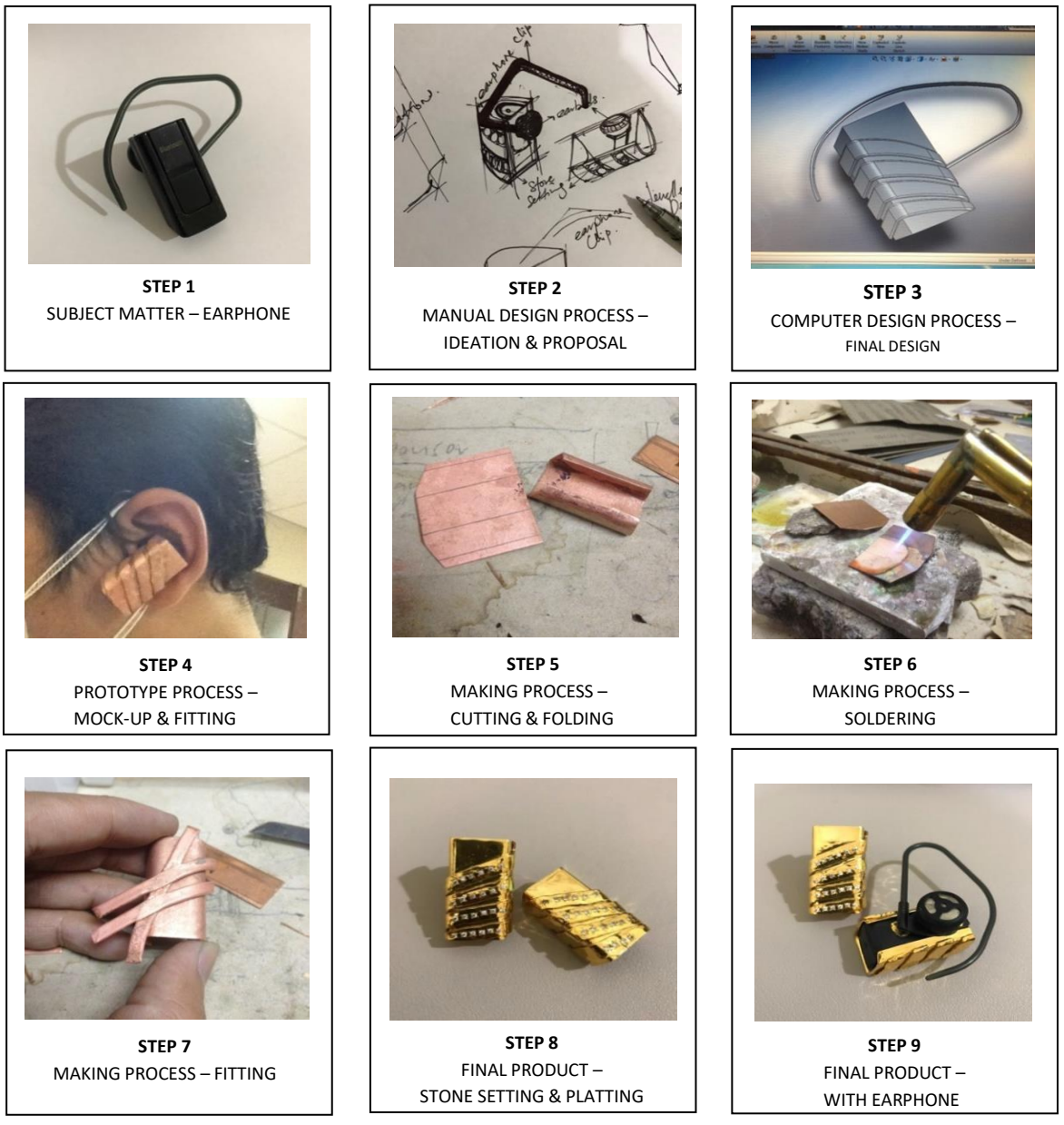

Figure 7. The steps of the design and making process

5.3 Evaluation of the Product

According to Marzuki (2013), there are two types of product evaluation which are: 1) design evaluation and 2) product evaluation. The former comprises its visual, appearance and function, the variety of choices of designs, the variety of choices of colors, Telesis, innovation, and the lifespan. Meanwhile for the product evaluation, it emphasizes on the function of the product, product suitability, size and weight, safety, ergonomic, packaging, price and maintenance.

The notion was supported by Nur Syafinaz et al. (2019) in the paperwork, "Jewelry Product Quality Evaluation Based on The Buyer's Choice of Kelantanese Women" that there are several contributing factors that encourage Kelantanese women to purchase jewellery. The factors are attractive and innovative designs, better quality products, variety of options to choose from, lightweight, ergonomic, and affordable price.

A pilot study had been conducted on nine respondents chosen based on their background. Among them are academicians, artists, designers, entrepreneurs and consumers. The nine respondents are:

1. Ts. Emilia Abdull Manan, Head of Academic Centre, Faculty of Art and Design, UiTMCawangan Kelantan.
2. Muhammad Muizzuddin Darus, Senior Lecturer, Industrial Design Department, UiTMCawangan Melaka.
3. Abu Bakar Abdul Aziz, Lecturer, Industrial Design Department, UiTM CawanganMelaka.
4. Shahrizad Fitri Mustapha, Lecturer, Fashion Design Department, Faculty of Art andDesign, UiTM Cawangan Perak
5. Alias Yussof, Full Time Artist and Designer, Keluli Studio, Selangor.
6. Abd Aziz bin Sulong, Jewellery Designer, Institut Kraf Negara.
7. Nur Shafira Mohd Nasir, Jewellery Designer, Assafiya Gold Empire, Terengganu.
8. Nurul Izzati Raizatul Akman, electronic devices consumer.
9. Nik Adibah Zalina Khairul Anuwar, jewellery consumers.

The feedback was collected through a questionnaire which was divided into two sections: Section A: Level of criteria evaluation on design which includes visual appearance, form & function, aesthetic, innovation, and life expectancy. Section B: Level of criteriaevaluation on product which comprises function, material, size and weight, ergonomic and safety. The questions presented in the questionnaire are as follows:

A. Criteria Level of Design.

1. Does the design successfully manifest electronic jewellery devices?
2. Does the design successfully manifest shapes and functions of the product?
3. Does the design created have appealing aesthetic values?
4. Is the design created considered as an innovation of electronic devices and jewellery?
5. Can the design last long?

B. Criteria Level on Product

1. Is the product practical and can function well as an electronic jewellery device?
2. Is the selection of materials (metal and plastic) suitable?
3. Is the size (3 cm x 1.5 cm) and weight (10 gm) of the product appropriate?
4. Does this product provide comfort for the users?
5. Does this product meet the safety requirement?

6 Analysis and findings

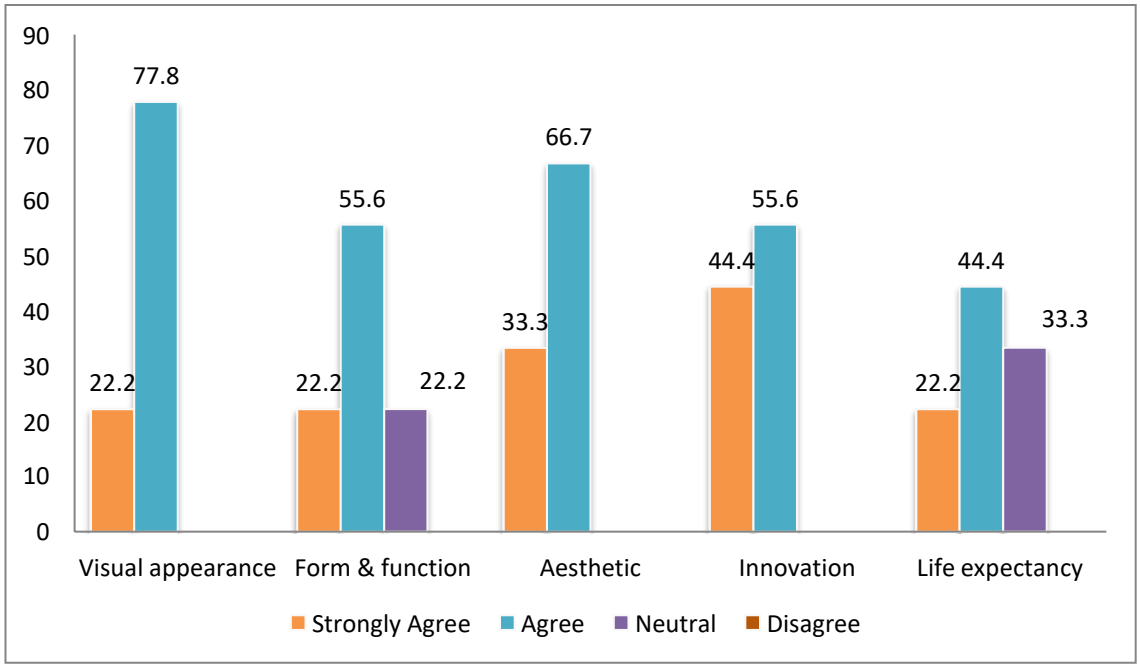

Figure 8. Evaluation Criteria for the Design of Electronic Jewellery

It was found that the evaluation criteria for the design of electronic jewellery were ranked between 22.2% and 77.8%. Respondents were recorded to agree with all five (5) indicators namely visual appearance, form & function, aesthetic, innovation, and life expectancy. The highest percentage, 77.8%, indicates that the respondents agreed that the design successfully manifests electronic jewellery devices.

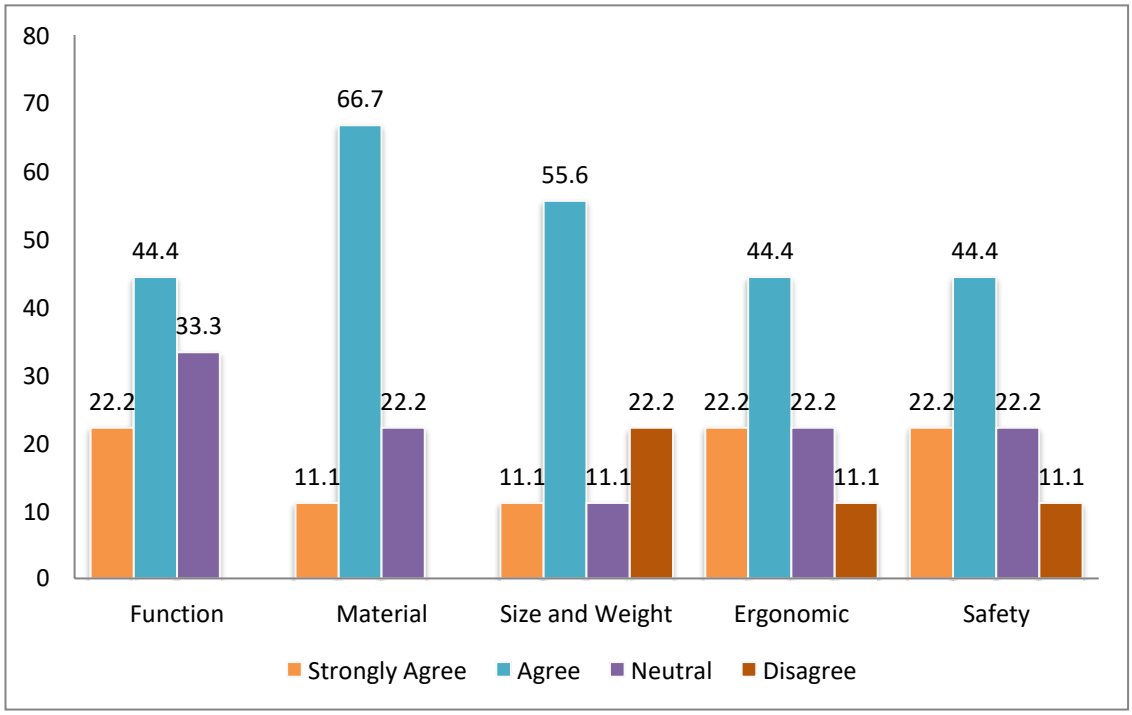

Figure 9. Evaluation Criteria for the Product of Electronic Jewelry

Based on Figure 9, it can be clearly seen that the percentage recorded was between 11.1% and 66.7%. Respondents chose to agree with all five (5) indicators namely function, material, size and weight, ergonomic and safety. The highest percentage recorded, 66.7%, illustrates that the respondents agreed with the selection of materials, metal and plastic, that are suitable for the product.

7 Conclusions and Recommendation

It can be concluded that the innovative combination of electronic devices and contemporary jewellery is a success proven with a high percentage (44.4% to 77.8%) of respondents who agreed that the design meets the evaluation requirements which are visual appearance, form & function, aesthetic, innovation, and life expectancy. These electronic jewellery devices also represent the characteristics of good quality products. This is proven by the result of 44.4% to 66.7% respondents who agreed with the function, material, size & weight, ergonomic and safety of the products designed.

Apart from that, there are several recommendations made for future research from the aspects of design and product. In terms of designs, it can be made for unisex, flexible, and friendly for all ear shapes. Other than that, the product size should also be considered and be made more comfortable and practical to be worn. Vast developed technology also plays a vital

role in the selection of electronic devices to ensure that it is suitable for the wearer and that it lasts long.

In conclusion, the innovation of electronic jewellery as a result of a combination of electronic devices and contemporary jewellery is a success. It can be seen from encouraging acceptance from the respondents in the aspects of design and product.

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