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Creation of Augmented Reality Version of Neat Space's Products

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Biographical Sketch

Trisha Joie Lucero is a fourth-year Bachelor of Arts in Multimedia Studies student of University of the Philippines Open University. She is a part-time student, a YouTube content creator, and an entrepreneur.

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Abstract

This project is a collaboration with Neat Space, an online furniture shop established in mid-2020. Their store is well-known for selling storage solutions such as floating shelves, racks, and rolling carts. Their chosen products, which include the "Heiho shelf set," the "Ozukai floating shelf," and the "Nordic Cube Rack," will be converted into 3-D models that can be viewed using Adobe Aero application. This project aims to develop an Augmented Reality prototype for an existing online store and test it with the store's potential market. The researcher hopes to learn about the impact on potential customers if they will be able to visualize products from online stores like Neat Space not only through images but also through augmented reality.

I. INTRODUCTION

1.1 The idea behind the project

Augmented Reality (AR) uses computer-generated images and 3D images that consumers can virtually use and test in real-life environments whenever and wherever they want, via applications and software on computers, tablets, and even smartphones. Neat Space sells storage solutions like floating shelves and racks; online shops like them can benefit from this technology. The first consideration in pursuing this project was its relevance to users' online shopping experiences. The second factor to consider is how AR will benefit Neat Space's online store. Furthermore, the third and final consideration is whether it will be convenient in the long run.

Considering the products offered by Neat Space, creating an AR version of their products came from the inability of consumers to visualize the product in their own space. What if their products could be seen in AR using customers' own devices? Furthermore, what if consumers could use AR to interact with products in their real-time surroundings?. The 'Spatial Computing' project of Albert Hwang had a significant impact on this research. Part 2 of his three-part video series on his website covered spatial computing for online shopping. He developed a prototype in which he interacts with virtual products in real-time.

AR is one of those significant innovations that technology and the Internet have made available to their users. Different fields such as Education (Saidin et al., 2015), Engineering (Olalde Azkorreta, K., Olmedo Rodríguez, H., 2014), and Medicine (Tang et al., 2020) widely adopted the use of this immersive technology. AR technology can help improve consumers' online shopping experiences and satisfaction (Chao-Hung et al., 2015). It increases the number of times customers spend interacting with the product or brand. AR technology in the online world has increased sales and customer interest in products to be tested using a phone or tablet (Galer, 2021).

In recent years, social media and technology in online product advertising have significantly changed how businesses interact with their customers, how they improve their products, and how consumers perceive their products. Utilizing AR technology in online shopping gives limitless possibilities for consumers and sellers. With AR, brands will be able to connect with their customers through digitally augmented products that consumers can view in their real-time environment. This project aims to create an AR version of Neat Space's products for potential customers to try and experience using their Shopee accounts.

II. REVIEW OF RELATED LITERATURE

2.1 Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI)

As the years pass by, the evolution of modern technology and its uses and purpose are rapidly developing. Today's society now uses the ideas that people could only see in science fiction movies and television shows before (Farshid et al., 2018). The use of information and communications technologies (ICTs) and the Internet made it possible for their users to think of limitless possibilities and create inventions that no one could ever have thought were possible before. Immersive technologies such as AR, VR, and AI are becoming increasingly popular due to the advancement of technology (Flavián et al., 2018).

Their uses in modern computer games, shopping, entertainment industries, and even people's day-to-day lives are prevalent in today's society (Pavithra et al., 2020). Algorithms are used in AI to analyze data and patterns (Boucher, P., 2020). One example is smartphones with facial recognition capabilities (i.e., Face ID).

Moreover, computer and mobile phone games utilize software and applications that allow users to experience VR and AR. The only difference is that the former uses a special headset for its users to experience the virtual world (Cipresso et al., 2018). The latter can even use a single device to see the augmented image or graphics (Cipresso et al., 2018).

Furthermore, some applications offer an AR experience to their users. The first example is the IKEA application, where customers can test and try their products using the application and their phone. The second example is the mobile game called "Pokémon Go," where users can play the game in their real-time environment,

enabling them to catch Pokémons, fight in battles, and create their teams while navigating real-time in their surroundings (Wingfield & Isaac, 2016).

2.2 Augmented Reality (AR) Technology and Online Shopping

AR in retail can be traced back to 2008, when a brand used it for marketing and commercial purposes (Javornik, 2016). Consumer expectations are changing with the rapid advancement of technology (Fernandes, C.R., & Tharakan, A.I., 2021). They have become wiser in selecting products they can purchase both online and in-store; consumers often search for product reviews and ratings before buying a specific product (von Helversen et al., 2018). Technology, combined with the power of the Internet, enabled businesses to operate efficiently and expand their services and product promotions worldwide by utilizing the Internet and social media platforms (Wang Y., 2021). Several games and applications combine real-time environments with augmented computer-generated graphics and images, which they can view using a tablet or a mobile phone (Carmigniani, J., & Furht, B., 2011). The use of AR Technology in online shopping allows users to try on products in the comfort of their own homes or even at work, similar to how consumers try products in offline stores before purchasing.

In today's information age, where people are more informed and interested in what they see online and on various social media platforms, brands and businesses are developing and implementing technology that is more innovative and has the potential to attract more customers. Furthermore, technological advancements and milestones have made it significantly easier for consumers to acquire software and

programs that they may use to see AR-ready graphics and images, even when using their mobile phones.

2.3 Consumer's Behaviour in using AR Technology

The distinction between the digital and physical worlds blurs as immersive technologies advance (Tom Dieck & Han, 2022). Every year, various tech companies introduce new technologies that offer more convenience and improve people's lives, which often becomes people's lifestyle. Connectivity and technological advancements shape how the present society lives. What makes it more interesting is that the users of these technologies are co-creating this digital environment right before their eyes. People can now enter the digital world using VR headsets and see computer-generated images using their smartphones.

Yim, M., Chu, S., & Sauer, P. (2017) conducted a research study where they tested two study models. The first study compares AR displays and Web product displays, and the second study is the effect on consumers' evaluations of AR displays. Both study models showed that AR displays are more appealing and effective to consumers because of the immersive shopping experience it gives than Web product displays. When viewing products online, the virtual presence provided by immersive technologies such as AR influences customers' willingness to purchase online (Leonnard et al., 2019).

Consumer behavior and satisfaction with online platforms and shopping online are changing in today's society. People can access information, visit various platforms, and use a wide range of software applications with a single click on their computers and mobile phones. Immersive technologies like AR serve as a bridge

between the digital elements and the users' physical environment (Arena et al., 2022).

2.4 AR Technology, E-commerce applications, and the COVID-19 pandemic

Since the pandemic, online shopping has multiplied in popularity (Rao et al., 2021). Shopping for goods and services online has become the new normal worldwide. With the various COVID-19 restrictions, such as avoiding public and crowded places, many people opt for online delivery services to purchase commodities and goods (Schmidt et al., 2021). People now value the convenience and time savings of online goods and services. The growth of online shopping improved the quality of the shopping experience for consumers (Bilgihan et al., 2016) and enabled merchants and entrepreneurs to reach a wider audience (Phonthanukitithaworn et al., 2019).

In response to the lockdowns and quarantines during the pandemic, various brands and retailers used AR technology to give their consumers the ‘try-before-you-buy’ experience online (Papagiannis, H., 2020) which gives customers assurance and confidence when buying products online (Romano et al., 2020). Adapting to this ‘new normal’ and expanding brick-and-mortar stores on various online platforms and applications required a significant shift for entrepreneurs. Access to the Internet, smartphones and up-to-date software and applications are not always readily available for everyone (Valarezo et al., 2019).

Although some entrepreneurs have quickly adapted to the so-called ‘new normal’ in online selling, there are those left behind in this technological shift (Engidaw, A.E., 2022). Entrepreneurs must not only have the necessary equipment

(ICT devices, internet connection, and various software and applications) to develop AR-ready products but also skilled individuals who can create these AR-ready products. Consumers must also have the necessary gadgets, applications, and software to test and try readily available AR products online. Access to information immersive technologies and knowledge of how to use and implement them will enable entrepreneurs to adapt to this change.

III. METHODOLOGY

This research project involves the use of Information and Communication Technology (ICT) devices (i.e., Mobile phones and tablets), social media and e-commerce platforms (i.e., Shopee Philippines), and the use of Augmented Reality (AR) software (i.e., Adobe Aero). With the permission of the owners of Neat Space Shop, three of their products, namely: the Heiho shelf set, Okuzai floating shelf set, and Nordic Cube rack, are used and turned into Augmented Reality (AR) objects. This project had two phases:

- Phase 1: The Prototype Development Phase
- Phase 2: An Initial Evaluation Phase

Phase 1: Prototype Development Phase

This research project began by creating images of Neat Space's products as AR objects using the Adobe Dimension application. The researcher used a draft sketch to list the sizes and colors of the products.

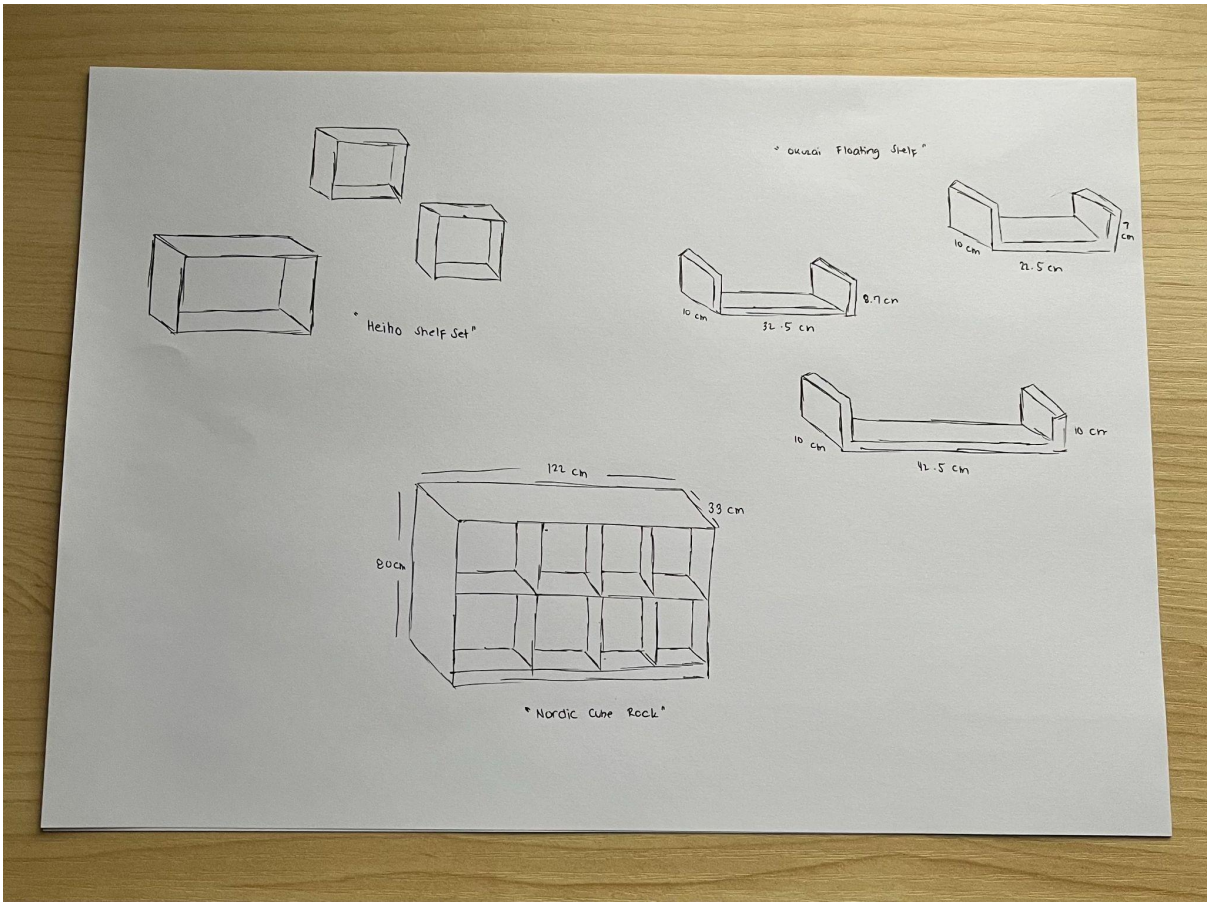

Figure 1. Draft sketch of the products of Neat Space.

Following the creation of the draft sketch, Adobe Dimension was used to create the 3D image of the products; the only base color available in Adobe Dimension that corresponds to the actual color of the products is 'walnut wood.' One of the most challenging aspects of developing products into 3D images is arranging and scaling them to how they will be positioned – vertically or horizontally. They will be visible in the Adobe Aero application based on how they are positioned in the Adobe Dimension application.

Figure 2. 3D images of Neat Space products using Adobe Dimension.

It is essential to highlight that this research did not use nor create any codes for launching the AR products. The "image anchor" feature of the Adobe Aero application was used as an image sensor for the augmented images to appear on the screen. Furthermore, the QR codes given in this research project were also generated from the Adobe Aero application. After trial and error of the image testing, the 3D images of the products can now be used using the Adobe Aero application.

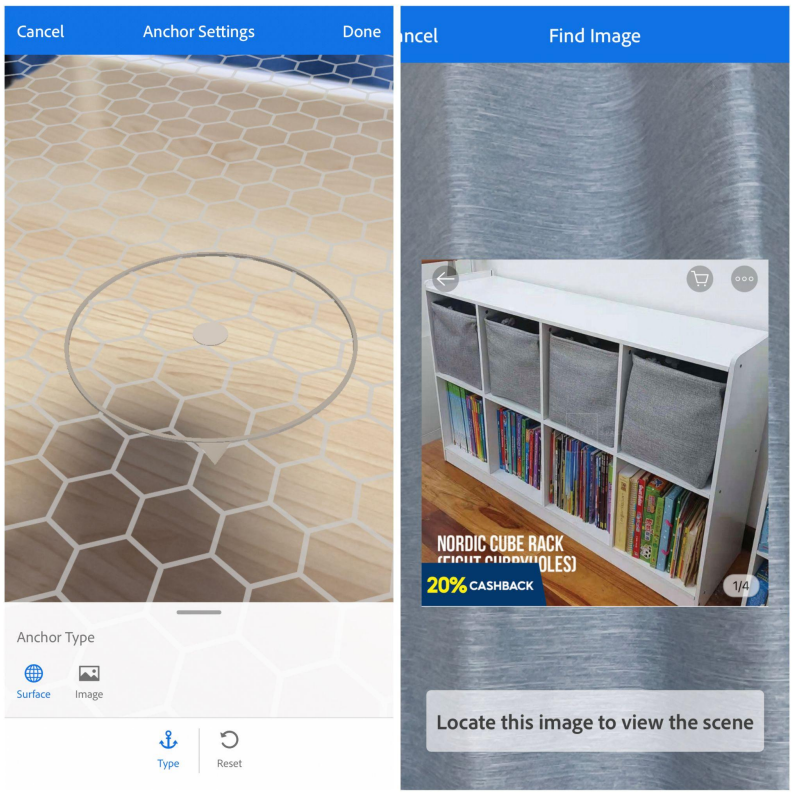

Figure 3. Image Anchor feature of Adobe Aero application.

Figure 4. AR product testing using Adobe Aero and its "image anchor" feature.

Phase 2: Initial Evaluation Phase

For this project, the eight random participants were instructed to try and test the product first before answering the online survey form. Before the AR version product testing, the researcher gave an online video guide (see appendix C) to the participants of this research. In the given online video guide, participants will know how they will scan, use, and see the AR version product. They need to download the "Adobe Aero" application first. Then, they were instructed to search for the Shopee account of Neat Space on their browsers. Three Neat Space products, namely: the Heiho shelf set, Okuzai floating shelf set, and Nordic Cube rack, have AR-ready QR codes. The researcher instructed the participants to scan the QR code using their smartphones to be able to see and test the AR version products.

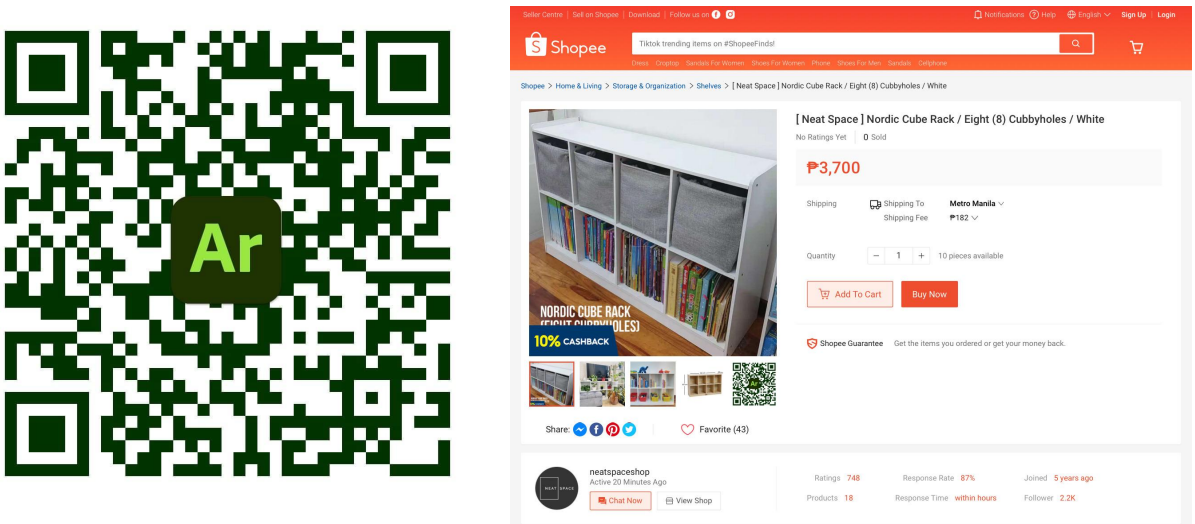

Figure 5. Neat Space's "Nordic Cube Rack" product listing on Shopee and its AR-ready QR code | Source: https://shopee.ph/neatspaceshop

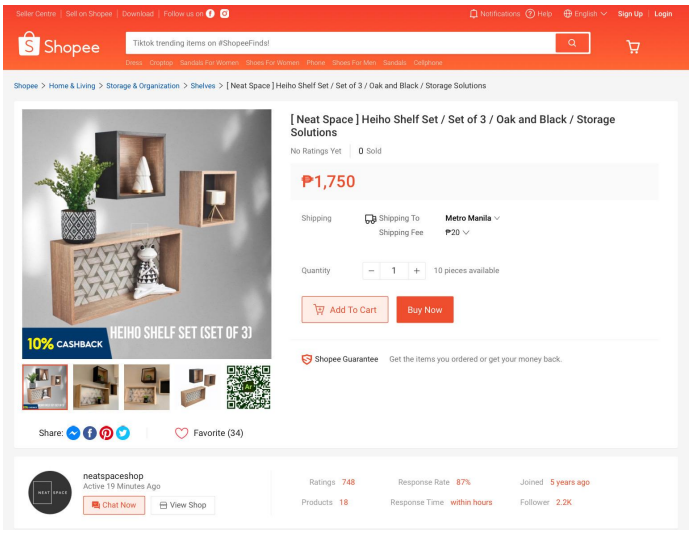

Figure 6. Neat Space's "Heiho Shelf Set" product listing on Shopee and its AR-ready QR code | Source: https://shopee.ph/neatspaceshop

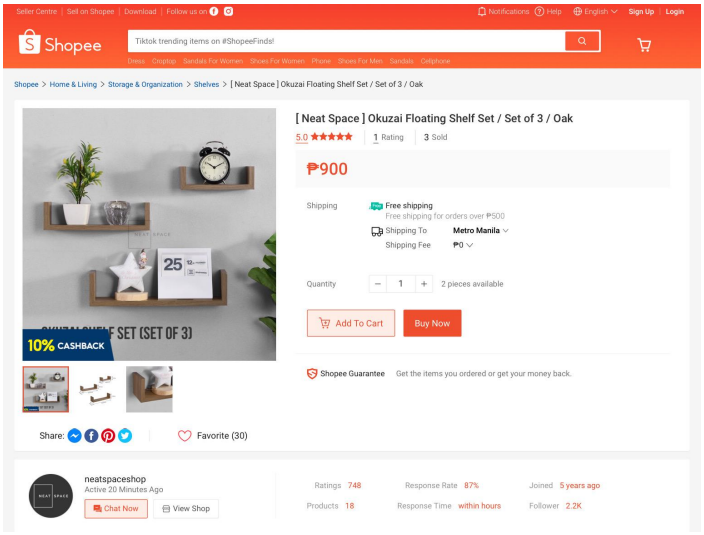

Figure 7. Neat Space's "Okuzai Floating Shelf Set" product listing on Shopee and its AR-ready QR code | Source: https://shopee.ph/neatspaceshop

The participants will be able to see the AR version of the products using their ICT devices (smartphones, tablets, laptops, and computers) like the following images below:

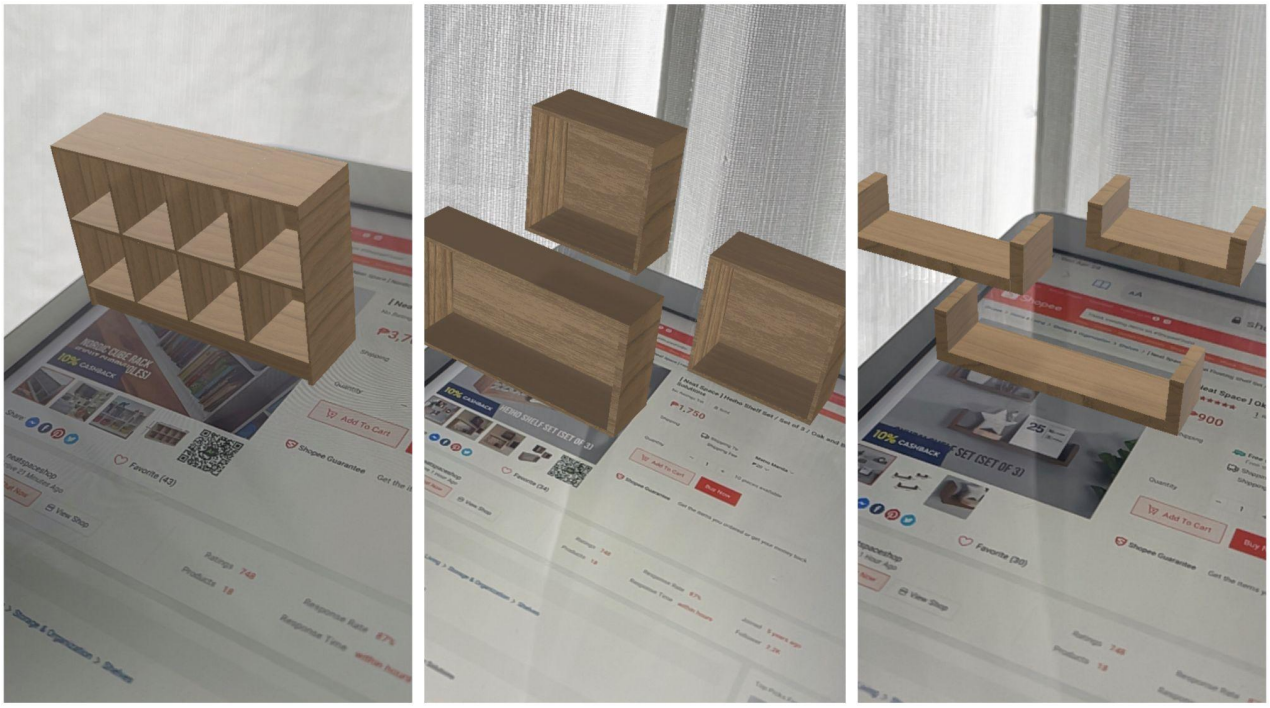

Figure 8. AR version products after scanning the QR codes and using Adobe Aero.

The researcher then instructed the participants to scan another QR code to try and test the AR version products in their surroundings during the final part of the recording. It gave the participants the option of deciding where to place the product. As a result, they will have an idea if they try to buy it online. Unlike the QR codes in Figures 5–7, the QR code in Figure 9 has yet to be placed and used in Neat Space's Shopee account due to issues with the actual sizing of the product when viewed with the Adobe Aero app. However, this issue can be addressed in future research.

Figure 9. QR code of "Nordic Cube Rack" for real-time surroundings testing.

Figure 10. Testing of AR version of "Nordic Cube Rack" on real-time surroundings.

3.1 Participants

Eight random individuals who use various e-commerce applications and platforms to purchase goods and services were asked to try and experience Neat Space's AR products. They are asked to record themselves while trying and testing the AR version products on their devices (see Appendix A). They were then asked to answer questions using an online survey form (see Appendix B) about their AR experience afterward.

IV. RESULTS AND DISCUSSION

The responses from product testing and online survey forms were gathered and analyzed to determine the effect on consumer behaviors when online products can be viewed in AR.

4.1 General Observations

The online survey results show that seven out of eight interviewees are female. Five out of eight interviewees are between the ages of 19 and 25. All interviewees have experienced online shopping, and seven out of eight interviewees stated that it was their first time trying the AR technology.

On their experience with Augmented Reality (AR) Technology

The researcher asked all the participants to join in the trial and testing of AR version products of Neat Space first before answering the online survey form. Because of the threat of COVID-19, which caused the inability of the researcher to do house-to-house interviews, the participants were the ones who recorded themselves while trying the AR products. They also sent the raw videos to the researcher for analysis and the documentary video (see appendix A). As this is an AR product trial, the researcher wants to see how the consumers will react to AR-ready products and to the idea of where e-commerce websites in the Philippines will utilize AR.

In the first part of the AR-ready product trial, the researcher asked the participants to select one of the AR-ready products from Neat Space's Shopee account and scan the QR code found on the product listing. Based on the video recording that the participants sent, they were surprised by the technology they encountered. Most of their responses in the given online survey (see figure 11) were that it was their first time trying an AR product in an online shop – most of them were surprised how they could see the product in front of their device. Although some of them already saw how AR works online, seven out of eight interviewees first experienced AR technology through this research.

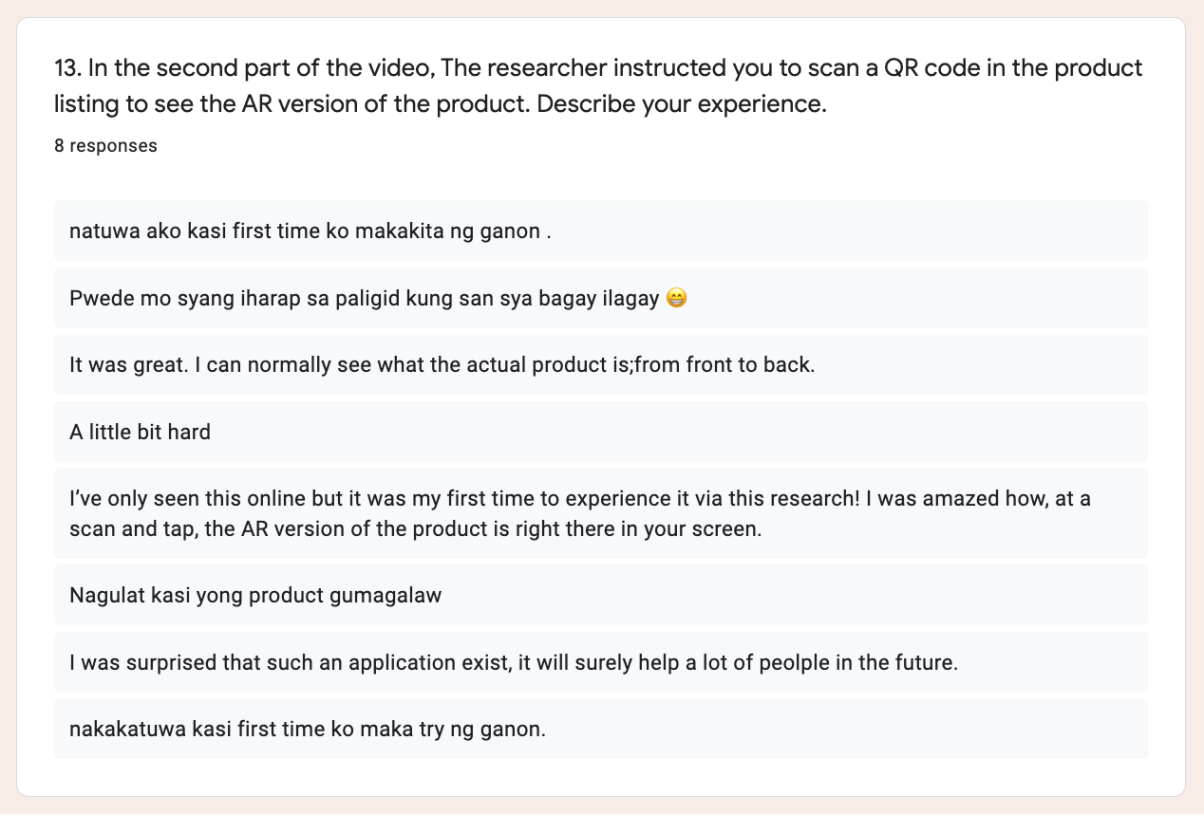

Figure 11. Participants' responses from online survey results [AR product trial on Shopee]

In the second part of the AR-ready product trial, the researcher asked the participants to scan another QR code (see figure 9) to test the AR-ready product in their real-time surroundings. Based on the video that the participants sent, some of them had a hard time locating a stable place where they could pin the AR product – the Adobe Aero application needs to locate a stable horizontal area for the product to appear on the screen. Most of the respondents in the given online survey (see Figures 12 and 13) were amazed by how they could view and place the product in their real-time surroundings. This experience also gave them an idea of how AR technology will work for online furniture shopping.

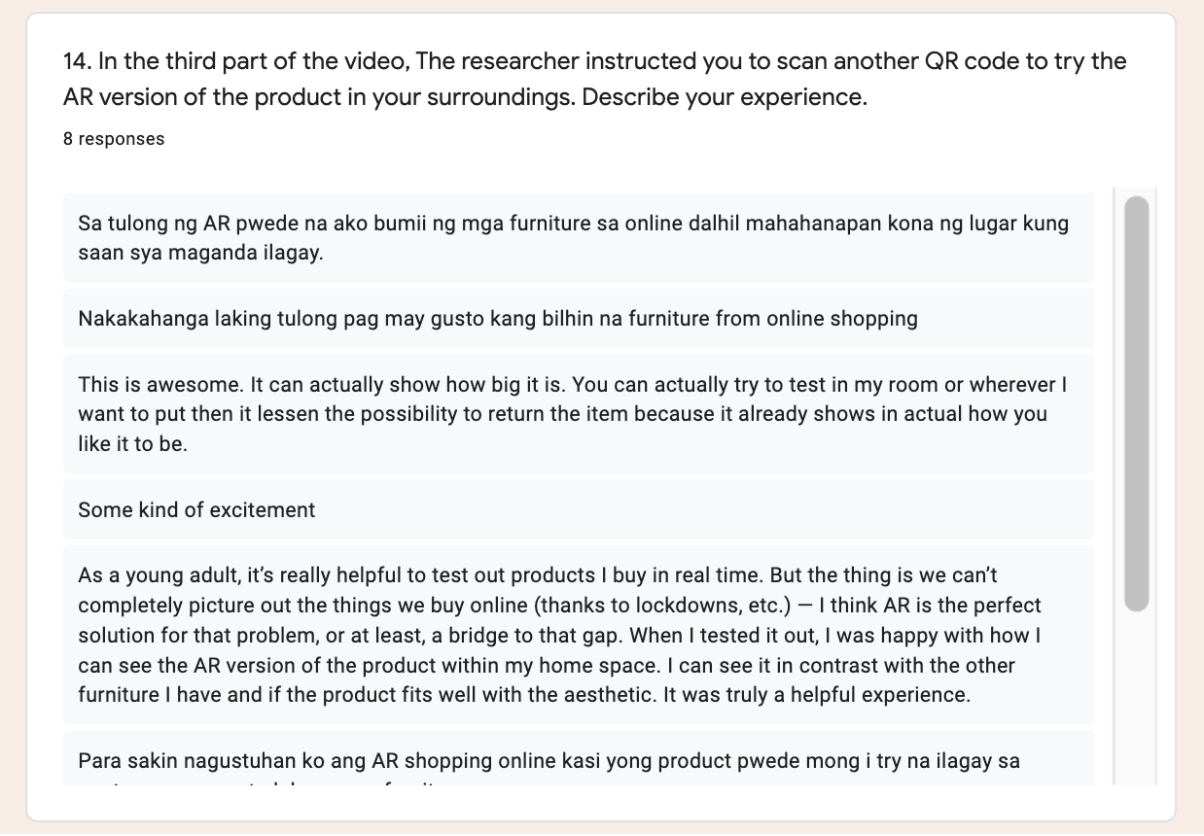

Figure 12. Participants' responses from online survey results [AR product trial in their real-time surroundings]

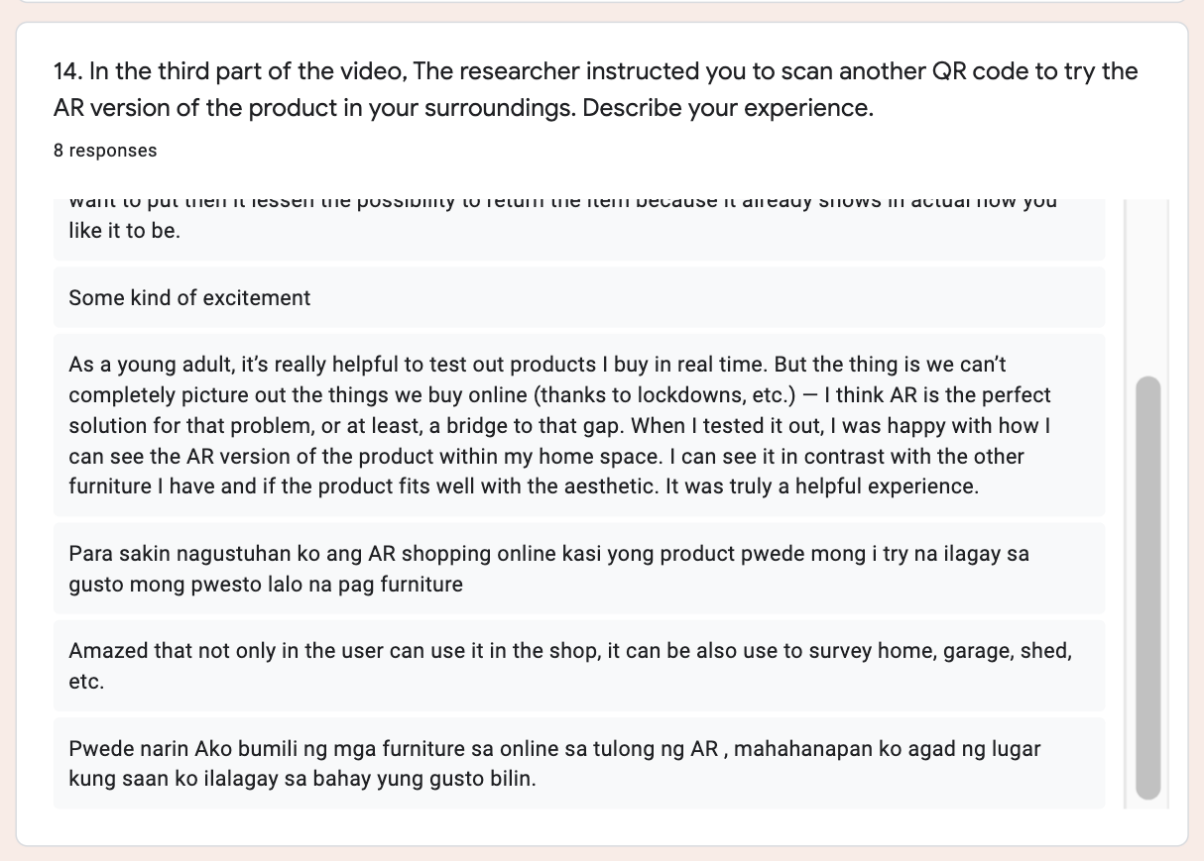

Figure 13. Participants' responses from online survey results [AR product trial in their real-time surroundings]

On their opinion about AR technology in online shopping

In the last four questions in the survey, participants were asked about their insights regarding the use of AR in online shopping. All participants think that the online AR shopping experience is convenient (see figure 14). Moreover, all participants also think that AR technology could help them buy things like furniture online (see figure 15).

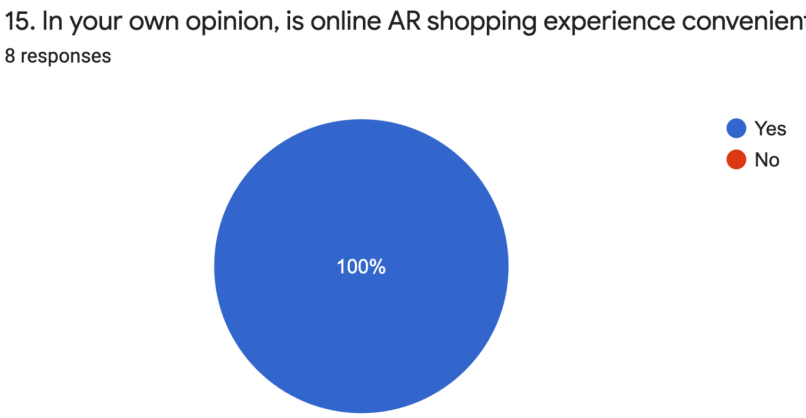

Figure 14. Participants' response if the AR shopping experience is convenient for them.

Figure 15. Participants' responses if AR will help buy furniture online.

Furthermore, the researcher also asked the participants how likely they want to buy at an online shop that offers AR versions of their products (see figure 16). Two out of eight participants answered somewhat likely, while six out of eight participants answered very likely.

Figure 16. Participants' responses on how likely they will shop at an online shop offering AR versions of their products.

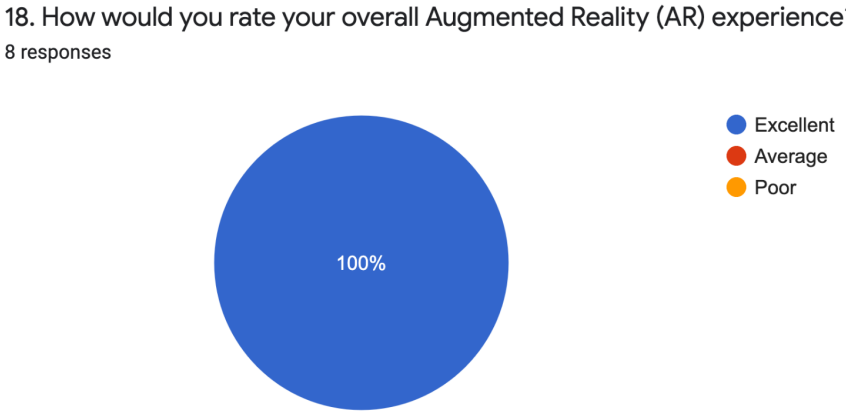

Figure 17. Participants rate their overall AR experience.

In response to the final question, participants who used the AR product rated their AR experience as excellent (see figure 17). Based on the online survey results, there are three reasons why AR technology could be beneficial and relevant to businesses today. First is the kind of interactivity that it gives to its consumers.

Through this project, the researcher found out that if products found online are AR-ready, consumers could visualize them using their phones and tablets in the comfort of their home, office, or even in other public places.

Figure 18. Testing AR-ready products in this vertical Space on the Adobe Aero app.

Second and third, it is more realistic and convenient. When shopping online, consumers frequently need to look for the measurements of the product they found online. To see if it will fit into the space where they intend to put the product, this could reduce the number of return item cases where the product's dimensions posted online are incorrect. With AR-ready products, customers will be able to visualize the product in the Space where they want to place it using their mobile phones and tablets. Figure 18 shows the researcher using a tablet to perfectly visualize one of Neat Space's products, named "Heiho," a brown shelve that would

look good for portraits or displays that a visitor would first see when visiting a home or an office.

Figure 19. Close-up look of how AR products can be visualized.

The researcher discovered that products turned into 3D images with their exact dimensions using applications like Adobe dimension; consumers will have no trouble determining whether or not the product will fit in the space they want to put it in. With AR technology, consumers will have the ability to try and test the products whenever and wherever they want.

V. SUMMARY AND CONCLUSION

This research project discussed how AR prototypes were developed and how they can be used by potential customers using QR codes. Aside from allowing consumers to test and try products online and in real-time, it has also made it easier for sellers and entrepreneurs to display their products (i.e., furniture, shelves, drawers, and so on) on various e-commerce platforms like Shopee. The consumers of the present era are more informed and cautious when purchasing items online. As a result, it is critical for businesses to innovate and explore new ways for their products to be easily accessed and interact with prospective buyers and target markets.

Consumers drive business operations, and if entrepreneurs can offer better and more innovative ways for their customers to shop online, businesses will be able to grow and earn more. It can be concluded from this research project that if entrepreneurs use technology to its full potential, it can provide triple benefits to their businesses and provide new shopping experiences to their customers.

VI. LIMITATIONS AND FURTHER RESEARCH

This study, like all others, has limitations that will be addressed in future research. The researcher only used an existing application called "Adobe Aero" and its "Image anchor" feature to visualize the product by scanning QR codes. Future research could improve the use of AR by developing immersive software that is readily installed on e-commerce websites and smartphones, allowing AR to be used without the need for another application. Further research could also enhance, stabilize, and provide the exact size of the products when viewed in AR.

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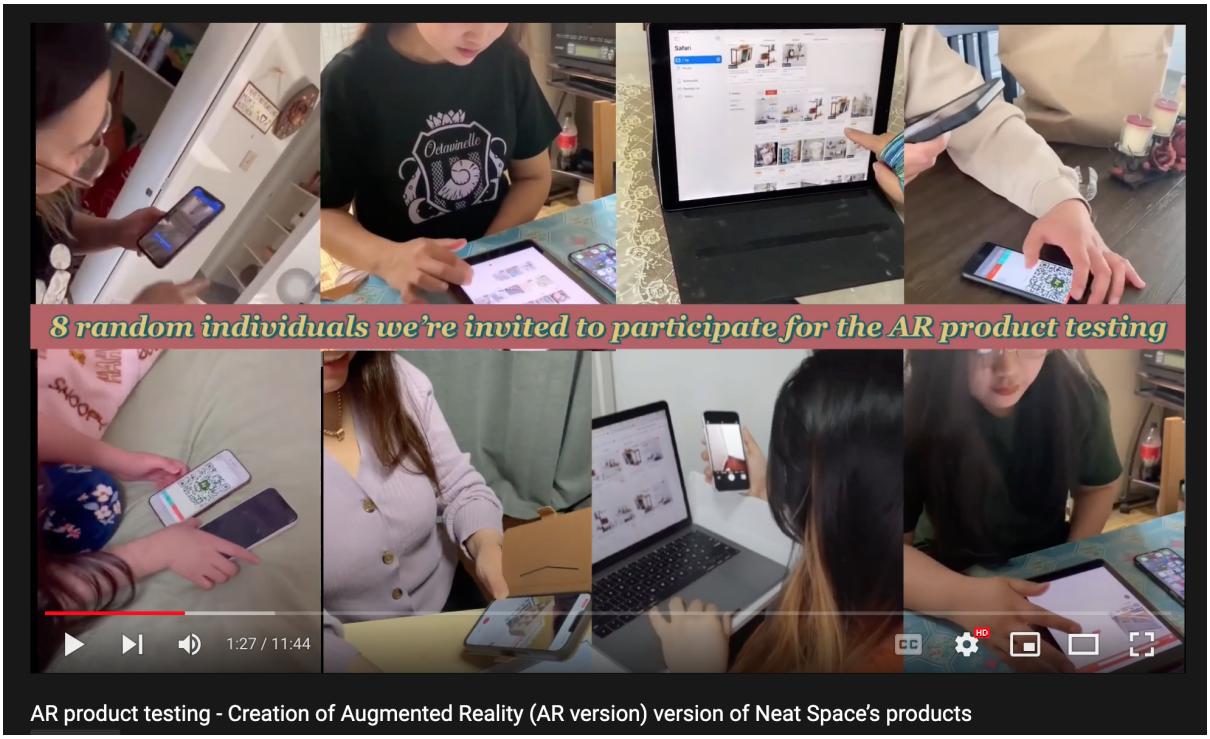
VIII. APPENDICES

APPENDIX A: AR product trial and testing video of 8 participants



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APPENDIX B: Online survey form

Multimedia Research Survey

Greetings!

I'm Trisha Joie Lucero, a multimedia student from the University of the Philippines Open University. I am conducting this research for my MMS200 course in partial fulfillment of the requirements for the degree of Bachelor of Arts in Multimedia Studies. This online survey aims to know your experience using the Augmented Reality (AR) version of Neat Space's products.

Please answer all the questions provided in this survey.
All your personal information and responses will be used for academic purposes only.
Thank you. :)

*Required

Q: Demographic

1. 1. Full Name *

2. 2. Please indicate your Gender *
Mark only one oval.

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Bisexual
- ◯ Homosexual
- ◯ Transgender

3. 3. Please indicate your Age *
Mark only one oval.

Online Shopping

4. 4. Have you ever tried shopping online? *

Mark only one oval.

- ◯ Yes
- ◯ No

5. 5. What are the ICT devices that you use for online shopping? *

Check all that apply

Tick all that apply.

- ☐ Computer
- ☐ Laptop
- ☐ Tablet
- ☐ Smartphone
- ☐ Other: _____

6. 6. What are the e-commerce websites you use or used for online shopping? *

Check all that apply

Tick all that apply.

- ☐ Shopee
- ☐ Lazada
- ☐ Amazon
- ☐ eBay
- ☐ FB Marketplace
- ☐ Alibaba
- ☐ Other: _____

7. 7. How many times do you shop online BEFORE the COVID-19 pandemic? *

Mark only one oval.

Mark only one oval.

- ◯ Every week
- ◯ Several times per month
- ◯ Once per month
- ◯ Several times per year
- ◯ Once per year

8. 8. How many times do you shop online DURING the COVID-19 pandemic? *

Mark only one oval.

Mark only one oval.

- ◯ Every week
- ◯ Several times per month
- ◯ Once per month
- ◯ Several times per year
- ◯ Once per year

9. 9. Have you ever tried buying furnitures online? *

Mark only one oval.

- ◯ Yes
- ◯ No

10. 10. What do you think is the common problem with buying furnitures online? *

Check all that apply.

Tick all that apply.

- [ ] Customers were not able to try it before buying it.
- [ ] There are limited options. (Some products are not available online)
- [ ] There are extra delivery charges.
- [ ] Online products are more expensive.
- [ ] Other: _____

Augmented Reality (AR) Experience

11. 11. Is this your first time trying Augmented Reality (AR) Technology? *

Mark only one oval.

Mark only one oval.

- ◯ Yes
- ◯ No

12. 12. In the first part of the video, The researcher instructed you to browse Neat Space's shopee account for about 15-30 seconds. What was your initial reaction to the shop? *

You may answer in English, Tagalog, or Taglish

_____

_____

_____

_____

_____

13. 13. In the second part of the video, The researcher instructed you to scan a QR code in the product listing to see the AR version of the product. Describe your experience. *

You may answer in English, Tagalog, or Taglish

14. 14. In the third part of the video, The researcher instructed you to scan another QR code to try the AR version of the product in your surroundings. Describe your experience. *

You may answer in English, Tagalog, or Taglish

15. 15. In your own opinion, is online AR shopping experience convenient for you? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Other: _____

16. 16. Would an online AR shopping experience help you buy things like furniture online? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Other: _____

17. 17. After this experience, how likely are you to shop at an online shop that offers an Augmented Reality (AR) version of their products? *

Mark only one oval.

Mark only one oval.

- ◯ Very likely
- ◯ Somewhat likely
- ◯ High unlikely

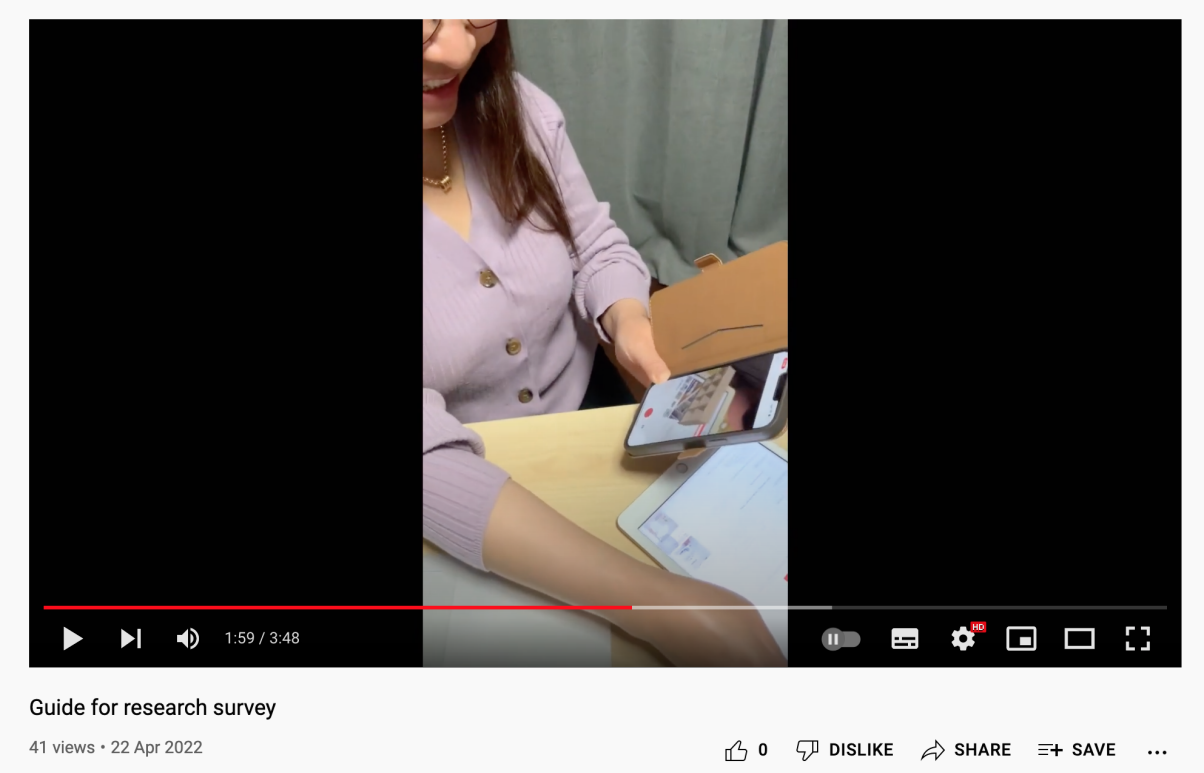
18. 18. How would you rate your overall Augmented Reality (AR) experience? *

Mark only one oval.

Mark only one oval.

- ◯ Excellent
- ◯ Average
- ◯ Poor
- ◯ Other: _____

APPENDIX C: Online Video Guide



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