



Preservation of West Java Culinary Recipe Using Augmented Reality, Photogrammetry, and Storytelling Illustration

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ABSTRACT

Many traditional culinary recipes from West Java, Indonesia are lost because they are not well-documented; this is a concern for many parties. Losing the recipe means losing the "artifacts" of traditional culinary and precious history and philosophy, which are part of local wisdom. Therefore, modern documentation is needed, which is informative, interactive, engaging, and loved by the young generation. This research is about designing West Java traditional culinary recipes using augmented reality, photogrammetry, and storytelling illustration. This study employs action research. For the data collection method, structured interviews with West Java culinary lecturers and Assemblr Augmented Reality (AR) apps creators were used. Then, this data will be used as content for proposing a design solution. Based on the research conducted, the attempt to preserve West Java culinary recipes using augmented reality, photogrammetry, and storytelling illustration is determined by the extent of the fresh, fun, and fascinating concept in all these media to create an excellent first impression as an exciting medium. Once the audience is interested, the transfer of knowledge afterward will be smoother. Fun and funny illustrations can generate the desire to find and taste these traditional foods.

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1. INTRODUCTION

Traditional cuisine from West Java, Indonesia boasts a unique diversity that reflects the social life, community order, lifestyle, culture, and spirituality of its era. Various types of traditional foods carry symbolic meanings that convey profound messages rooted in local wisdom. Understanding the

history and philosophy behind traditional foods provides a window into the mindset and lifestyle of past communities, which encompass a wealth of local wisdom in food preparation, presentation, and mealtime rituals. Preserving this local knowledge is crucial for the younger generation as it embodies the spirit and

wisdom of an entire nation of people (Vu Hoang, 2021).

Along with the times, technology and cultural boundaries are becoming increasingly fluid, and they mutually influence each other. Indonesian cuisine is not only influenced by cultures that have interacted with it in the past, such as India, China, the Middle East, and (colonial) Europe, but it can also be influenced by sources such as movies, music, television, and other aspects of pop culture. Based on these concerns, the author believes there is a need to preserve Indonesian traditional cuisine by transforming it into a modern form to attract the younger generation.

Augmented Reality (AR) is a system that possesses the following characteristics: it combines the real and the virtual, is interactive in real-time, and projects in 3D, allowing other technologies to interact with it, such as smartphone cameras (Azuma, 2001). This augmented reality is used in various fields, including games, education, health, the military, navigation, tourism, disaster management, and culinary applications (Yagol, 2018).

One of the successful applications of augmented reality in education is its effectiveness in enhancing content comprehension and long-term memory retention (Radu, 2013) through interactive visualization (Kerawalla, 2006) and boosting learning motivation in children (Juan, 2010). In a study conducted by Macchiarella, students who learned through augmented reality demonstrated better long-term memory retention compared to those who learned through books and videos within just one week. This demonstrates that augmented reality can significantly contribute to the learning process, facilitating a deeper and longer-lasting understanding of the material (Macchiarella, 2005).

Augmented reality is a useful tool for presenting storytelling in an engaging and

innovative manner (Askew, 2018). Indonesia has an augmented reality application called Assemblr, which can be downloaded on PlayStore and iOS. Assemblr itself is expected to serve as an augmented reality platform for this project.

Augmented reality has been widely employed in the culinary world, as seen with Domino's Pizza, which uses AR for pizza orders through the Snapchat app. This technology allows for broader engagement with the millennial generation, transforming old traditional recipes and food visuals to be more contemporary and serving as a medium for storytelling about the food's history and philosophy.

Photogrammetry is the art, technology, and science of gathering information about the environment or physical objects through processes involving the recording, measurement, and interpretation of photographic images and patterns of recorded radiant electromagnetic energy and other phenomena (Wolf, 2000). The standard definition of photogrammetry involves extracting measurements from 2D photographs and converting them into a 3D model (Foster, 2014).

One of the methods is called terrestrial photogrammetry or close-range photogrammetry. The camera is positioned on the ground and can be handheld, tripod-mounted, or pole-mounted. This photogrammetry method is typically employed for non-topographic applications (Sajinkumar, 2018). It is used to generate photo-realistic 3D models, such as furniture, interiors, and sculptures. When using close-range photogrammetry, the user can transform a 2D object into a 3D object by simply using a point-and-shoot camera to capture a series of 30–50 images. Several rules need to be followed to create a successful model, including ensuring a smooth transition between angles and taking an ample number of pictures. There are

software options available for creating photogrammetries, such as 3DF Zephyr. The authors used 3DF Zephyr Lite software and combined it with Autodesk Meshmixer to create the 3D food model.

Storytelling is the activity of telling or writing stories (Oxford, 2020). It is a cultural activity that forms the core of human learning experiences from childhood. Storytelling can be found in various forms of cultural activities, such as theater, performances, lectures, and more. In Indonesia, wayang or puppet performances are traditional storytelling experiences used to convey messages of good deeds. Storytelling is a three-way relationship between the teller, the story, and the audience, with each element of the triangle interconnected. It's about forging connections; stories come to life when they connect with an audience and the teller (Harvey, 2013).

Storytelling through illustration involves narrating a story or conveying a message using visual language, such as drawing or painting. It helps the audience better understand the message. Storytelling remains a three-way relationship between the teller, the story, and the audience, with each element of the triangle intertwined. Storytelling revolves around connections; indeed, stories thrive by connecting with an audience and the teller (Harvey, 2013).

Therefore, creating traditional West Java recipes using augmented reality, photogrammetry, and storytelling illustration can serve as interactive and persuasive media, reaching a broader target audience while preserving and documenting traditional culinary heritage. The more engaging the process of acquiring information, the easier it is to memorize.

2. RESEARCH METHODOLOGY

This study employed an action research model developed by Kurt Lewin. Action research involves learning by actively addressing a problem, attempting to solve it, assessing the success of the solution, and if unsuccessful, making further attempts (O'Brien, 2001). Regarding the design of augmented reality recipe illustrations, respondents can provide feedback to refine the design and achieve the objectives of this study.

Figure 1 shows the cyclical action research model by Kurt Lewin consists of four stages within one research cycle: plan, action, observe, and reflect. The planning phase encompasses preparations for conducting research, starting from literature studies to acquire the necessary theories, such as Augmented Reality, Photogrammetry, and Storytelling Illustration. This phase also involves interviews with Bandung culinary lecturers and Assemblr Apps creators. The action phase involves designing the recipe illustrations using Adobe Photoshop, implementing augmented reality using Assemblr, and creating food models through Photogrammetry using 3DF Zephyr Lite. The observation phase includes user testing through a questionnaire. The respondents consist of individuals living in West Java, Indonesia who have families and children. The reflection phase involves interpreting the data obtained from the questionnaire analysis. The questionnaire results are analyzed to identify shortcomings and failures, which are then used to formulate recommendations and revisions for the next cycle. If, however, the objectives are not achieved in the first research cycle, a revised plan will be implemented in the second research cycle.

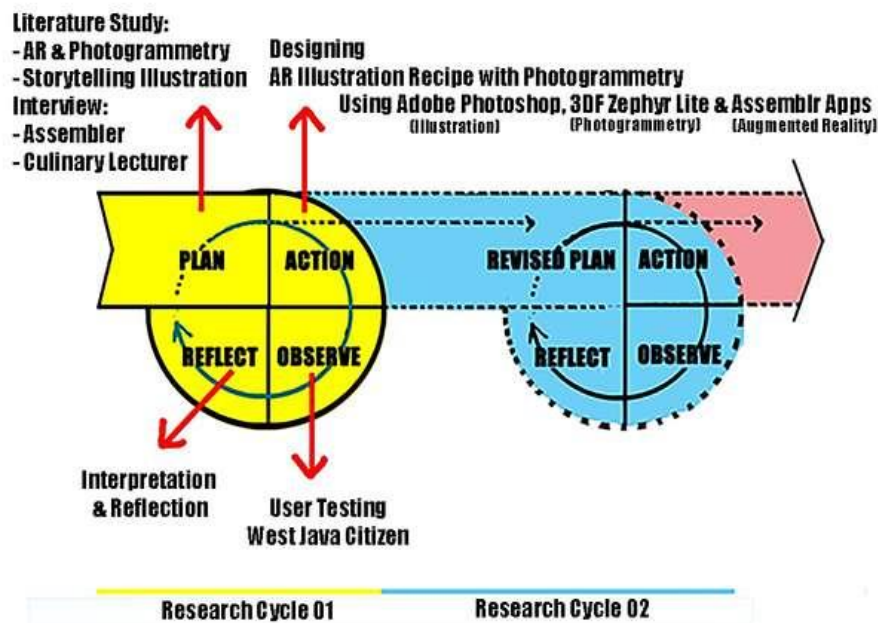


Figure 1. Research model used in this study

Plan: Data Collection

The planning phase contains a literature review, which has been described in the previous section and a structured interview.

Table 1. Structured Interview

No	Name	Category	Interview Date
1.	Hasbi Asyadidq	CEO & CCEO Assemblr Apps	August 26th & September 18th, 2020
2.	Anita Yustisia Prianamto	Lecturer of Akademi Tata Boga Bandung & Natural Cooking Club Community Member	August, 22th, 2020

In **Table 1**, the authors conducted interviews with three different interviewees using structured interviews. The first and second interviewees are the CEO and CCO of Assemblr App developer. Simultaneously, the third interviewee is a chef who also serves as a culinary lecturer and is a member of the Natural Cooking Club Community. After conducting interviews with

these informants, the authors obtained data to support the creation of AR Illustration Recipes. This data was analyzed and used to draw conclusions as part of the research outcomes.

Research Outcome

Based on the data collected from the interviews in **Table 1**, the research outcome can be described as follows:

- Based on an interview with a West Java culinary lecturer, preservation of the recipe can be done by focusing on providing information about the name and picture, not necessarily details about how the food is made. Burayot and Kadedemes are examples of traditional West Java food that must be preserved.
- Based on an interview with the Assemblr app's creator, photogrammetry can be used to create realistic 3D models for AR, but the polygon count needs to be reduced to make the size smaller. Storytelling is well-suited for the younger generation and can be accomplished using Assemblr's slideshow feature,

as well as the drag-and-drop of 3D objects from the library or the image-import feature.

Research Cycle 01

In the first cycle, the writer will focus on designing a recipe illustration that will be appealing to the target audience. At this stage, the augmented reality and photogrammetry models have not been created yet.

Action: Prototype 01

- The concept of storytelling illustration is fresh, fun, and fascinating. These three concepts were chosen to enhance informative and persuasive values.

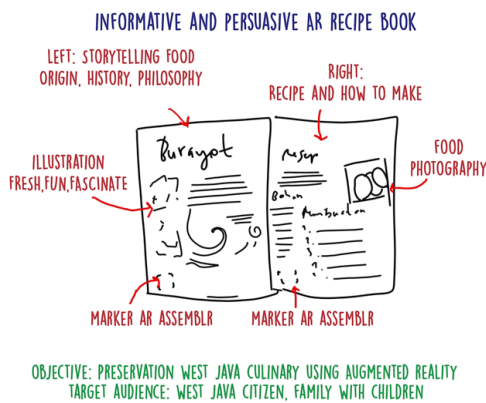


Figure 2. Illustrative manuscript sketch

- In **Figure 2**, the illustrative manuscript is divided into two main pages. The left page contains storytelling, and the right page is for recipes. Based on the interview, the writers will emphasize the name and picture of the food instead of the detailed recipe. Resulting in creating the drawing illustration, photograph, and 3D model of the food (photogrammetry).

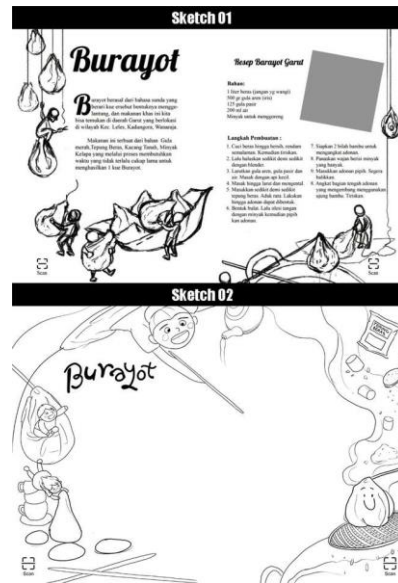


Figure 3. Two alternative sketches

- In **Figure 3**, we selected Burayot, based on a suggestion from the interviewee, as one of the traditional foods of West Java to be illustrated. Two sketch alternatives have been created, and these two alternatives will be tested to determine the best benchmark for the illustration.

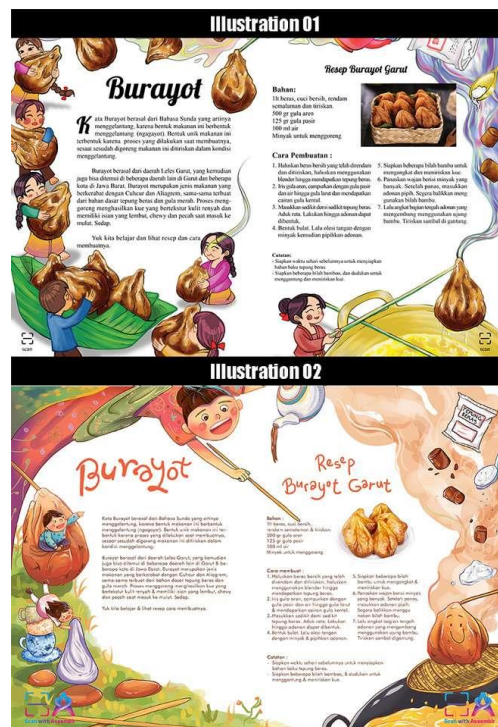


Figure 4. Finished Illustration

- In **Figure 4**, the two illustrations were created using Adobe Photoshop and a Pen Tablet. To convey the new value, the illustrations use natural and vibrant colors with warm tones. To convey the fun aspect, cheerful children's characters interact with food objects, which have faces and expressions. To convey the fascinating aspect, the illustrations use a framed layout composition adorned with children's characters and the food-making process.
- The storytelling illustration describes the process of making Burayot, starting from the ingredients to the cooking phase. This helps visualize the storytelling narration on the left page. The narration includes elements of narrative exposition, such as the name of Burayot, its history, place of origin, raw ingredients, and its unique taste.

Observe: User Testing 01

The writers conducted user testing on 30 respondents during the first week of October 2020, ranging in age from 8 to 70 years old.

In **Figures 5 and 6**, based on these results, 40% of the respondents preferred the first layout and illustration, while 60% of the respondents favored the second layout and illustration. Among the respondents, 40% were aged between 8 and 17 years old, 53% were between 18 and 65 years old, and 7% were above 66 years old. Additionally, the respondents comprised 40% males and 60% females.

The layout and the first illustration were preferred by adults due to the larger font size, whereas the younger respondents chose the second illustration, which was considered more fun and had a more playful approach.

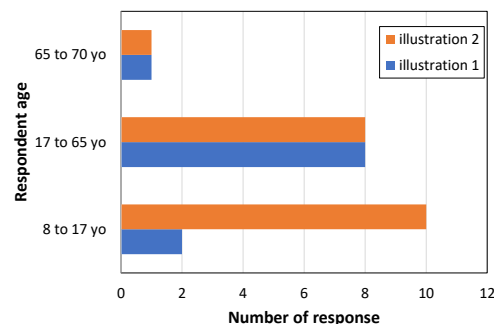


Figure 5. Design preferences by age

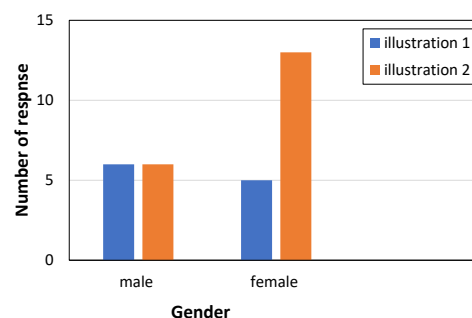


Figure 6. Design Preferences by gender

Reflect

Based on the results of the first user testing, the second type of illustration will serve as a benchmark for creating illustrations for other food recipes. The fun and humorous elements of the characters will be incorporated as objects in the Augmented Reality storytelling.

Research Cycle 02

In the second cycle, the writer will use the second illustration as the base illustration for the recipe and then incorporate augmented reality and photogrammetry objects.

Action: Prototype 02

The writers utilized close-range photogrammetry. The photogrammetry process involved the use of a mirrorless Lumix G85 camera, a softbox, a mini studio box, and turntables. The writers employed various methods to capture high-quality photos:

- The first way, food is rotated 360 degrees by hand, then the writers

took 50 photos manually and images imported to 3DF Zephyr lite to turn into 3D objects. The result is that the 3D form is not created entirely and is unusable. The writers did it 3-4 times, but the result was the same.

- In the Second way, the writers used a turntable and placed the food above it, then automatically took 25 photos using time-lapse mode. The pictures are taken from two different angles, and the total number of the image taken become 50. The result is a smooth transition between angles and the produced 3D model of the food is perfect.

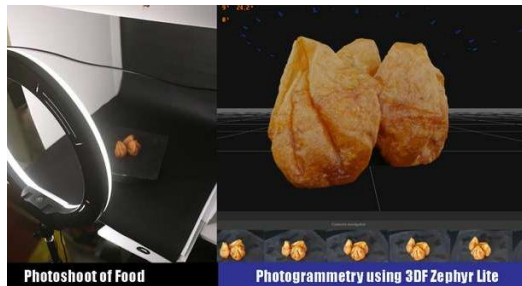


Figure 7. Photogrammetry process

In **Figure 7**, after the writers captured the 50 photos (left image), they imported them into the 3DF Zephyr Lite App and converted them into 3D objects (right image). According to the research outcome, the size needed to be small. The 3D results were then exported in .obj format to facilitate further editing in another application, allowing for the adjustment of polygon size.



Figure 8. High polygon vs low polygon

In **Figure 8**, the 3D file size was initially 41.6 MB, which was too large for an AR file. The author then edited the high-polygon model, converting it into a low-polygon model using Autodesk Meshmixer software, resulting in a file size of 5.83 MB. This reduced size is adequate for importing into Assemblr Apps and ensures easy loading for users.

Augmented Reality Storytelling

Augmented reality is created using the Assemblr Studio app. The author uses an illustration of Burayot. A child character then creates a 4-page slideshow containing descriptive storytelling, starting with the name, city of origin, materials, and a message.

In **Figure 9**, after the audience installs the Assemblr App, they can use the scan feature to scan the printed illustration and make the marker appear on their phone. The left side features the storytelling part, while the right side displays the photogrammetry food model.



Figure 9. Marker Scan with Assemblr App

The audience can interact with the model using their fingertips, enabling actions such as rotation and resizing. If the user touches the 'X' button beside the Burayot character, a description part will appear. The illustration places emphasis on the Burayot character, featuring various

expressions to connect with the audience. At the end of the slides, the writers add the conclusion phase, which conveys the message to encourage people to find and try Burayot.

In **Figure 10**, the writers have created a four-slide augmented reality storytelling using narrative exposition. Each slide features the Burayot character standing in a rectangular grass area with trees and stones as decorations. The writers have employed a contrast of green and orange colors to make the Burayot character stand out. The contents include the introduction, the meaning of the name, the hometown, and the message.

Observe: User Testing 02

The authors conducted user testing on 30 respondents from the 3rd to the 4th week of October 2020 in Bandung, with ages ranging from 8 to 70 years old. The authors met with the respondents and provided them with illustrations and cell phones that had the Assemblr application installed.

Figure 11 describe the details of the method used for Testing. Based on **Figure 11** there are two methods to collect the data: first, based on the observation of the expressions and emotions when the respondents saw the Augmented Reality, and second, based on interviews.

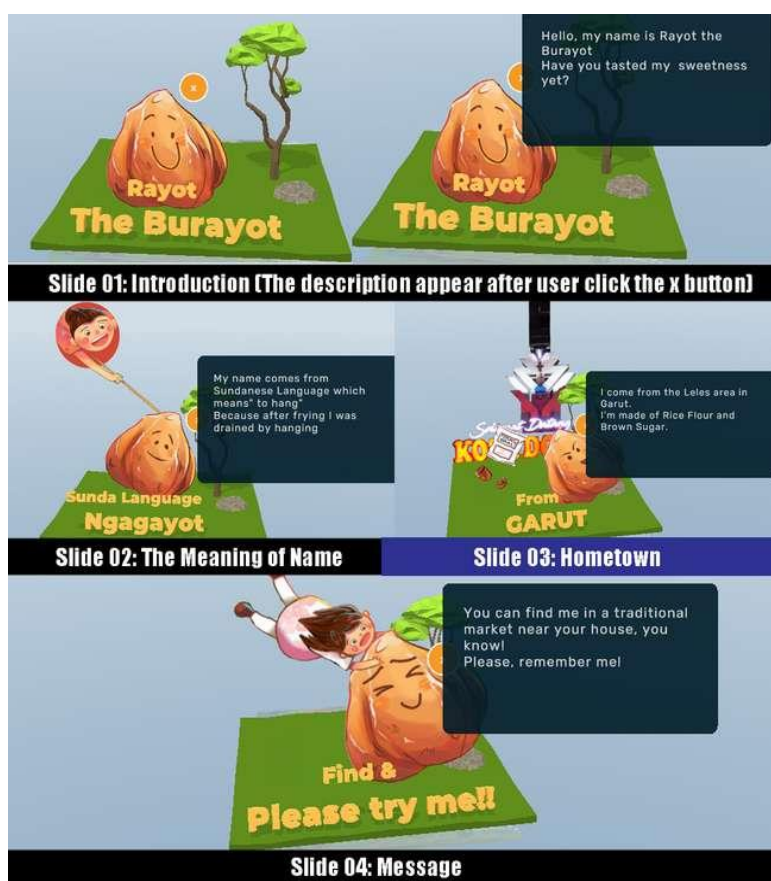


Figure 10. Illustrative manuscript sketch

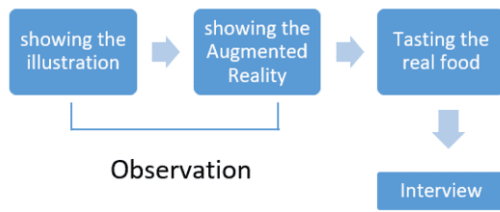


Figure 11. Test flow

The respondents included both parents and their children depicted on Figure 12. After conducting the user testing, the authors provided them with Burayot to try. In Figure 13, based on the observation of the expressions and emotions of the respondents, 90% of the respondents immersed themselves when playing with an AR application on their cell phones, while only 10% of the respondents showed no interest.



Figure 12. User Testing

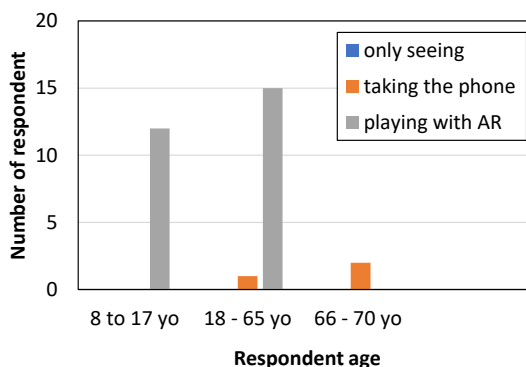


Figure 13. AR expression and emotion

In Figure 14, the results show that 50% of the respondents had never heard of Burayot, 16% had heard of it but never tried it, and 34% had already tried Burayot.

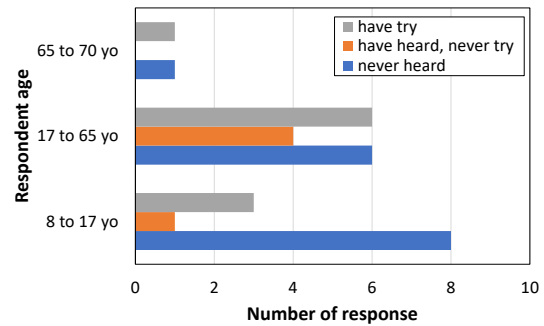


Figure 14. Burayot knowledge

3. RESULTS AND DISCUSSION

The user testing outcome can be described as follows:

- The first impression of the illustration attracts the desire to get more information. 100% of the respondents are interested in the two illustration sheets shown. They wear happy expressions, don't mind waiting, and exhibit curiosity about augmented reality.
- The first impression of playing with augmented reality: 100% of the respondents found it to be an exciting medium.
- After seeing the illustration and augmented reality, 90% of the respondents expressed a desire to find and taste Burayot.
- After seeing the recipe, only 15% said they might be interested in making their own Burayot, while 75% preferred to buy and find it in the marketplace.
- Although not asked in the questionnaire, respondents hope to receive more information about more than just one type of food; they hope that illustrations and augmented reality can be created for various traditional foods from different provinces, not just West Java.
- Adult respondents are willing to download applications only if they

can access more information, not just for one recipe or one occasion.

- Based on interviews regarding the new value, which involves the use of natural and bright colors with warm temperatures, 100% of the respondents agreed that the color conveys freshness and fun.
- Based on interviews regarding the fun value, which involves the use of cheerful children's characters who interact with food objects that have faces and expressions, the respondents agreed with it and mentioned that it reminded them of childhood book illustrations. The child respondents particularly loved seeing the happy facial expressions in the characters and food.
- Based on interviews regarding the fascinating value, which involves the use of a frame layout composition decorated with children's characters and the process of making food, the parent respondents agreed that the layout contributed to making them feel fascinated from the first impression. The child respondents also mentioned that this part made them feel excited because it was similar to their storybooks and made the food production seem easier to understand.

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4. CONCLUSION

Based on the research conducted, the attempt to preserve West Java, Indonesia culinary recipes using augmented reality, photogrammetry, and storytelling illustration is determined by the freshness, fun, and fascinating concepts presented in these media to create an excellent first impression as an exciting medium. Once the audience is interested, the transfer of knowledge becomes smoother. Fun and humorous illustrations significantly increase the success in generating the desire to discover and taste these traditional foods.

The first impression of the illustration will attract excitement and a desire for more information. The more appealing the illustration, the greater the user's willingness to continue searching for information. Augmented reality with photogrammetry helps make the displayed images appear realistic and provides a clear picture for users who have never seen the described objects before. While the availability of recipes may not create an immediate desire for users to cook, it at least serves as a reference if needed.

The experience and information provided will create a positive memory for the user. Of course, this must be supported by the ease of use of augmented reality applications.

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