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Designing an Android-Based Advergame Using Unity 3D and Firebase

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ABSTRACT

The high growth value of the culinary industry compared to other industries has caused the number of competitors owned by Kedai UKM to increase. To stay competitive, Kedai UKM uses an advertising strategy in the form of social media. However, because it was deemed ineffective, Kedai UKM needed innovation in promoting UKM shops. One form of innovation in the advertising world is to use a video game. An advergame is a form of advertising that is currently booming, used to advertise a product or brand where the product or brand is inserted into a video game (In-Advertising Game) or transformed into a video game (Pure Advertising Game). The results obtained from this study are in the form of an advergame prototype for the Kedai UKM restaurant, where the advertised brand and product will be inserted into a video game built as an application prototype with the Android platform. The application is built using the Rapid Application Development method and Unity3D software. To determine whether the application prototype receives a positive response from visitors, it will be tested using due diligence. If the average score exceeds 3 out of 5, the application and research will be considered feasible and successful.

Keywords: Advergame, Unity3D, Android, Mobile Application.

INTRODUCTION

In the era of digital transformation, global marketing strategies have evolved significantly, with gamification emerging as a powerful tool for customer engagement (Rasool et al., 2020; Zafar et al., 2025). Recent studies indicate that gamified advertising, particularly advergames, can increase brand recall by up to 87% and consumer engagement rates by 47% compared to traditional advertising methods (Terlutter & Capella, 2021; van Berlo et al., 2021). Mobile gaming, which reached 2.8 billion players worldwide in 2023, presents an unprecedented opportunity for businesses to connect with consumers through interactive entertainment (Suryani, 2023; Catalán, 2019). Specifically, advergames have proven effective in the food and beverage industry, where experiential marketing through gameplay creates memorable brand experiences and drives purchase intentions (Martí-Parreño et al., 2022; Maksi et al., 2024; Cañete Sanz & de la Hera, 2023).

Technology today has become a very inherent part of human life. Technological developments are also felt in several aspects of life, such as business, social and scientific development, to the culinary world (Putra et al., 2022). Currently, the culinary industry has a very rapid development (Mulyono & Rolando, 2024; Sinurat, 2021). According to data obtained from the National Culinary Development Plan, the culinary industry has a growth value of 56.07% of the total number of business units, amounting to 3,039,281 units in 2013 (ITB 2022), where the average value of business unit growth in the field of culinary is larger by 1.48%, superior to the average value of the creative industry and the average value of the national industry (Husin et al., 2021; Pusung et al., 2023).

This has caused the number of competitors owned by Kedai UKM restaurants to increase (Mulianingsih et al., 2022). Kedai UKM is a restaurant located in the South Tangerang district. The name Kedai UKM itself is taken from the initials of the names of the owners of

this business, namely Usman, Kardi, and Mufi. The store was established in 2018. To be able to continue attracting visitors and increase popularity in the eyes of the public, they decided to do advertising. Advertising is a form of mass communication through various media aimed at providing information or influencing people who see the advertisement (Renwarin, 2021). The type of advertising used by Kedai UKM (Usman, Kardi, Mufi) is advertising in the form of social media, specifically Instagram (Pramudya et al., 2024; Veranita, 2021), as a way to introduce and disseminate information about the restaurant (Saputra et al., 2024; Bakar 2023).

However, this is considered less effective because the number of visitors who come to the restaurant has not increased significantly. While existing research has explored advergames in various contexts, the integration of Unity 3D and Firebase specifically for SME restaurant promotion remains understudied. This research addresses this gap by demonstrating how these technologies can be combined to create scalable, cost-effective promotional solutions for small businesses with limited marketing budgets. Unlike previous studies that focused on large corporations, this work provides practical insights into advergame implementation for micro-enterprises.

This study addresses three key research questions: (1) How can product and brand information be effectively conveyed through an advergame format? (2) What are the technical requirements and implementation steps for developing an advergame for Kedai UKM using Unity 3D and Firebase? (3) How does advergame-based advertising compare to traditional social media advertising in terms of user engagement and promotional effectiveness?

The expected benefits of this research include providing SMEs with an innovative, low-cost promotional tool that leverages mobile gaming trends; demonstrating the technical feasibility of developing advergames using accessible development platforms; and contributing empirical evidence on the effectiveness of gamified advertising for small-scale businesses. The implications extend beyond the specific case study, offering a replicable model for other SMEs seeking to enhance their digital marketing strategies through interactive media.

METHOD

This research employs an applied-developmental design combining qualitative and quantitative methods. The qualitative approach is used to understand user needs and gather feedback through interviews and observations, while the quantitative approach is applied in usability testing to measure user acceptance and system effectiveness numerically.

The data collection methods used in this research include observation, interviews, and literature study. Observation was carried out to directly examine the actual conditions and activities occurring at the research site. The primary focus of observation was on visitors who came to the location, with the aim of understanding their behavior, preferences, and responses related to the research objectives. Through this method, the researcher was able to gather real-time data on how customers interact with the environment and how certain factors influence their engagement.

The interview method was employed to obtain in-depth information and personal opinions from the owner of the business. This process involved structured question-and-answer sessions regarding the atmosphere, environment, and the perceived effects of using video games as a promotional medium. The interviews provided valuable qualitative insights into the

owner's perspective on marketing strategies and how digital entertainment can enhance customer experience and business visibility.

In addition, a literature study was conducted by reviewing relevant journals, books, and other academic sources. This method was used to build a strong theoretical foundation and to support the analysis and discussion of the research topic. The literature review helped the researcher understand previous studies, identify research gaps, and ensure that the findings align with established theories and practices in digital promotion and customer engagement.

To support the creation of a system within a limited timeframe, this research adopts the Rapid Application Development (RAD) methodology. RAD is chosen because of its short development cycle and its emphasis on active user participation to ensure that the designed system meets user expectations. The stages of this method include: (1) Requirement/Planning, which defines the application scope and identifies the needs based on observed problems; (2) Design, which analyzes and maps functional requirements to develop a system model; (3) Construction, where the actual application is developed and tested for functionality and reliability; and (4) Implementation, where the finalized system is applied in the research object.

The research was conducted at a small restaurant located at Jl. AMD No.6, RT.1/RW.1, Pd. Kacang Barat, Kec. Pd. Aren, South Tangerang City, Banten 15226. The location was chosen because the owner of this micro, small, and medium enterprise (MSME) sought to explore alternative promotional strategies to increase customer visits. Therefore, the researcher selected Kedai Usman Kardi Mufi as the object of study to examine the effectiveness of using video games as a promotional tool in enhancing customer attraction and engagement. The research subjects consisted of 30 restaurant visitors selected through convenience sampling, with selection criteria including: (1) visitors aged 15-45 years (target demographic for mobile gaming), (2) visitors who own Android smartphones, and (3) visitors willing to participate voluntarily in the usability testing. Additionally, the restaurant owner served as a key informant for qualitative interviews regarding business perspectives and marketing strategies. All participants provided informed consent before participating in the study, and their data were handled confidentially in accordance with research ethics standards.

Data analysis was conducted using mixed methods. Qualitative data from interviews and observations were analyzed thematically to identify key insights about user preferences and business needs. Quantitative data from usability testing were analyzed using descriptive statistics, calculating mean scores and standard deviations for each usability dimension measured on a 5-point Likert scale. The threshold for system acceptance was set at a mean score of 3.0 out of 5.0, indicating that scores above this value would signify positive user acceptance and system feasibility.

RESULTS AND DISCUSSION

Designing Needs

The first stage in this study is to limit the scope in application development by looking at the research object.

Literature Study Results

Obtain data through journals, books and previous research results.

Observation Results

Visitors who come on weekdays are arguably quite few. Most of the visitors come from students and workers. While in the restaurant, the activities that visitors do are talking, playing video games and relaxing. Visitors who come on average use smartphones with an android operating system. Visitors from students relatively buy products at low prices or choose products that have promos.

New visitors will feel interested in coming when they see promotions shared by SME Shops through social media. When you want to redeem the promo given on *social media*, visitors who come must confirm whether the promotion advertised through social media is still available or not. If the promotion is still available, visitors can redeem the promo to employees who are in the restaurant.

Interview Study

The results obtained from the interview with the owner are that the number of visitors who come to the restaurant is uncertain, but it can be estimated that for weekdays the number of visitors who come is approximately 15 people, and for holidays the number of visitors who come is approximately 35 people. If calculated per week, the number of visitors who come is approximately 150 people.

Most of the visitors who came came from among students and workers with an age range of 17 to 35 years old and the purpose of their coming was to gather together and play games together. For one and a half years this restaurant has been running, they advertise using social media. When the restaurant uploads a new post, their maximum number of views is 50 views, where when the post is uploaded the number of visitors who come increases by 25 to 35 people.

Needs Analysis

SWOT Analysis

As an effort to identify strengths, weaknesses, opportunities, and threats in the design of a system, this analysis can also be used to determine whether the system should be maintained or reformed. (Ari Wedhasmara, 2017)

So that the analysis is divided into:

Strength

The average end result comes from students and workers, the majority of whom have an understanding of advertising in the form of video games.

Debilitation

The promo that is advertised still depends on the amount of income earned per month so that the promo cannot be given continuously, so visitors still have to confirm whether the promo is still available or not by asking the worker.

Chance

There have been many advertising media using video games. So that if this is implemented, it can attract visitors who have an interest in video games.

Threat

There are many rivals who have provided more attractive promos. In addition, the promotions provided by Kedai UKM did not spread well.

Problem Solving Analysis

When the analysis of the problem described using a SWOT analysis is completed. Next, a problem solving analysis will be carried out, where the problem solving analysis will use SWOT analysis using the combination method on each SWOT point.

The following is a description of the strategy that will be used.

Strategy Strength Oppurtunity

By utilizing visitors who have an interest in video games, the delivery of promotions using video games will attract visitors, most of whom are students.

Strategi Strength Threats

By providing a different advertising method, it will become a characteristic of a brand. So it will be easy to differentiate yourself from other competitors.

Weakness Opportunity Strategy

Many video games that are used as promotional tools will be an attraction for the recipients. With promos that can be adjusted to the situation of the restaurant, visitors no longer need to be afraid of running out of promos.

Weakness Threats Strategy

Video games have the opportunity to still attract people who don't like video games by simplifying the form of the video game itself.

System Design

Based on the results of data collection and needs analysis, data conclusions about users are obtained in the form of:

The age of visitors is between 17 – 30 years old.

Visitors who come come from among students or workers.

The video *games* required must be universal.

Points earned by players can be exchanged for promotions provided by restaurants.

In the application that is intended for visitors, it gives users the flexibility to choose promotions provided by restaurants.

In the user application, the promo that has been selected can be easily redeemed to a restaurant.

Promotions provided by restaurants can be arranged in an application owned by employees or restaurant owners.

Then the data will be analyzed according to its functional needs. The analysis will be carried out using the following two diagrams.

Usecase Diagram

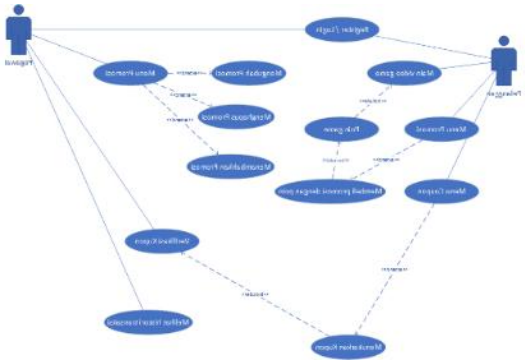

Figure 1. *Usecase Diagram*

The following is an explanation of the *Usecase diagram*:

Users will register an account through the application provided.

If the user already has an account, then the user can enter the main page of the application used.

Users with a player account can play the video games that have been provided.

Users with player accounts will earn points.

Points can be redeemed for promo coupons provided by restaurants.

Users with player accounts can see what promos they haven't exchanged for restaurants.

Users with employee accounts can add promotions.
Users with employee accounts can change existing promotions.
Users with employee accounts can delete existing promotions.
1. Users with employee accounts can verify promo coupons from customers.

Users with employee accounts can view customer redemption history.

Activity Diagram

To clarify the flow of the application, the creation of an activity diagram is created.

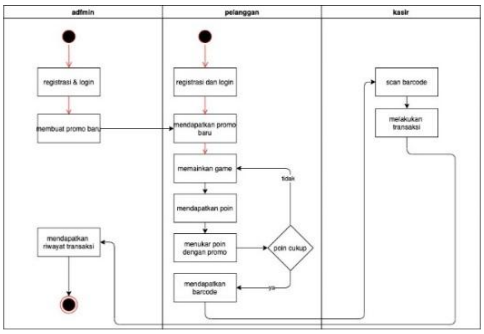

Figure 2. *Activity Diagram*

Employees who work in restaurants will make an offer in restaurants.
Customers look at attractive promos in the application. If the customer has a lower point than the desired promo, then the customer can play the videogame in the application.
When the points obtained are enough, customers can exchange the points they get for the offer they want.
When the customer wants to redeem the coupon he has, he only needs to show the coupon to the cashier and the cashier only needs to validate the coupon

Application Development

The application development process is divided into two, namely the development of a database for the application and the development of the application itself. For database construction, Firebase is used for research using the Cloud Firestore feature as a data store. Firestore itself is a cloud data base service chosen by Google. Firestore allows users to obtain data in an organized manner and can be used in real time by various platforms. (Gunadi, 2018)

In application development, applications are divided into two. For applications that are run and used by employees or owners of Kedai UKM (Usman Kardi Mufi), applications are built using Android Studio software using the Kotlin programming language. Here is the application for SME Shop employees (Usman Kardi Mufi):

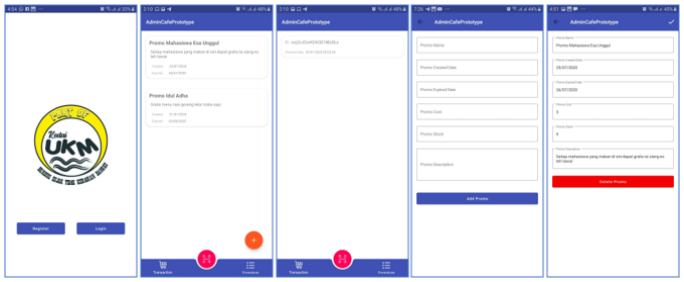

Figure 3. Employee Application Layout

For applications run and used by customers from Kedai UKM (Usman Kardi Mufi) built using Unity3D which is built with the android platform. Unity itself is a game engine developed by Unity Technologies Inc. *Scripts*, which are used in can allow the resulting applications to be run on various platforms. (Tjahyadi et al., 2015)

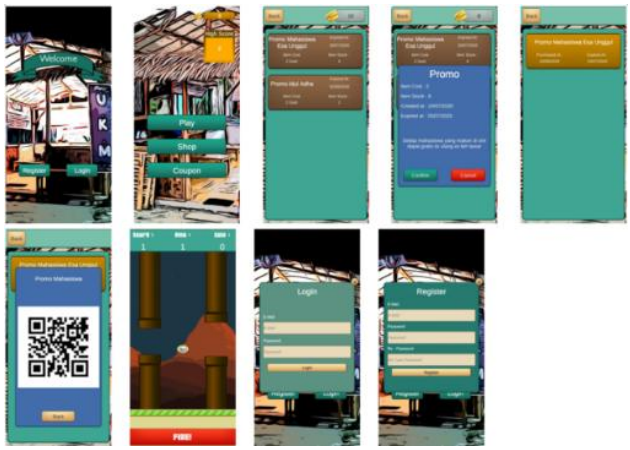

Figure 4. Visitor Application Layout

The two applications will then be connected using Firestore with the following collection and document arrangement:

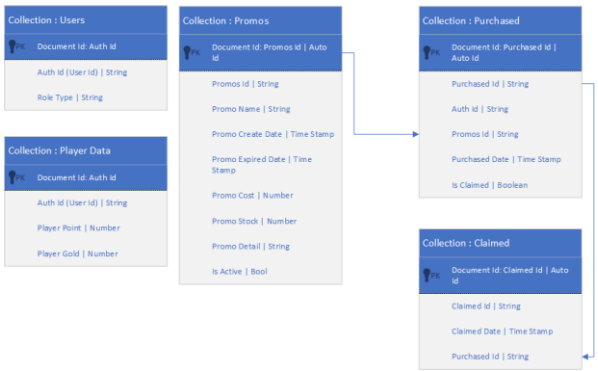

Figure 5. Overview of *Collection* Stack and *Document Firestore*

Testing Application

To ensure that the application runs well, in-application testing is needed. So that if there is an error in the application, then the application can be repaired.

Black Box Testing

The functional check of the application will be divided into several parts, where each part will explain the activities carried out based on the type of actor. (Mustaqbal et al., 2015)

Testing the Visitor application

Table 1. Customers Play Games

No	Input	Expected results	Results obtained
1.	On the main menu, press the play menu	Enter the game page	Successful, the system successfully runs the video game
2.	Touches the entire main layer	The player will move	Successfully, the system successfully detected the touch of the
3.	Pressing the fire button	Shooting bullets	Successfully, the player can shoot bullets
4.	Successfully overcome obstacles	Earn scores, gold and ammo	Successfully, players get scores, gold, and ammo when passing through bamboo.
5.	Hitting obstacles	Popup game over popup	Successfully, the system managed to bring up game over popups

No	Input	Expected results	Results obtained
6.	Falling to the ground	Popup game over popup	Successfully, the system managed to bring up game over popups
7.	The bullet managed to hit one of the obstacles	Resistance disappears	Success, when a bullet hits the bamboo, the bamboo will be lost

Tabel 2. Pemain *Game Over*

No.	Input	Expected results	Results obtained
1.	When a player loses	A game over popup appears showing high scores, scores, and gold obtained	Successfully, the system managed to show the number of player scores, player highscores, and gold that players got.
2.	Pressing the restart button	Will repeat the game	Successfully, the game was successfully repeated.
3.	Press the main menu button	Head to the main menu	Successfully, the system managed to display the main menu with the number of scores and gold that changed.

Table 3. Players Choose the Shop Menu

No.	Input	Expected results	Results obtained
1.	On the main menu, press the shop menu	Enter the store page, displaying all existing promotions	Successfully, the system successfully displays promotional data provided by restaurants
2.	Choosing one of the promo items	Popup details of the selected promo item	Successfully, the system successfully displayed the details of the promotional data provided by the restaurant.
3.	Press the buy button when the amount of stock is still available with the amount of gold equal to or exceeding the promotional coupon price	Display a successful purchase notification	Successfully, the system successfully displays purchase notifications, with the number of stock and player gold reduced.
4.	Pressing the purchase button when the amount of stock is still available with less than the promotional coupon price	Displays a failed purchase notification due to lack of gold	Successfully, the system successfully displays a notification that the gold owned by the player is less than the amount of the selected promo
5.	Press the buy button when the coupon stock is empty with enough gold coupon	A notification that the promotional coupon has run out of stock	Successfully, the system successfully displays a notification that the stock of promo coupons selected by the player has run out.

Tabel 4. Pemain Memilih Menu *Coupon*

No.	Input	Expected results	Results obtained
1.	On the main menu, press the coupon menu	Enter the store page, displaying all the cups owned by players that have never been exchanged for a restaurant	Successfully, the system successfully displays promo coupon data that has been successfully purchased by players.
2.	Choosing one of the coupon items	Popup QR Code popup to confirm redemption to restaurants	Successfully, the system successfully displays QR codes
3.	The coupon was successfully scanned and pressed the back button	Coupons that have been redeemed will disappear from the list of coupons you have	Successfully, the system resulted in removing the player's coupon that he had used.

Usability Testing

To find out whether the application made has met the eligibility of its users, it is necessary to test the feasibility of this Usability taken according to the type of actor.

Usability Testing Admin Application

Table 5. Usability Testing Admin

Respondent	Scale values based on the questions given										Average
	1	2	3	4	5	6	7	8	9	10	
1.	4	4	5	5	4	5	5	3	4	5	4.4
2.	4	5	5	4	5	5	5	4	4	4	4.5
3.	4	4	5	5	4	5	5	4	4	4	4.4
4.	5	4	4	5	4	5	5	3	4	4	4.3
5.	5	4	4	5	3	4	5	4	5	4	4.3
6.	5	4	4	5	4	5	5	4	4	5	4.5
8.	5	4	4	5	4	5	5	4	4	5	4.5
9.	4	5	5	4	4	5	5	5	5	5	4.7
10.	5	5	4	5	4	4	5	4	5	4	4.5
Total											**44.8**
Average											**4.48**

The data in the table above was taken from 10 respondents with a percentage of 50% waiters, 20% cashier and 30% owner. After processing the data, the total score of the average results of the questions asked to the user was 44.8 points, with an average of 4.48 points from the overall answer results.

If it is concluded, the workers and owners of the SME Shop (Usman Kardi Mufi) are already satisfied with the performance of the application.

Customer Application Usability Testing

Table 6. *Customer Usability Testing*

Respondent	Values based on the questions given										Average
	1	2	3	4	5	6	7	8	9	10	
1.	4	5	5	4	4	4	5	4	4	4	4.3
2.	4	5	4	4	4	3	5	4	3	5	4.1
3.	4	4	5	4	3	4	4	3	4	4	3.9
4.	5	5	5	5	5	5	4	4	5	4	4.7
5.	4	3	3	4	5	4	3	3	3	3	3.5
6.	4	4	4	4	4	4	4	4	4	4	4
8.	4	4	3	3	4	3	4	3	2	3	3.3
9.	4	4	4	4	4	4	3	3	-	4	3.7
10.	5	5	5	5	5	5	5	5	5	5	5
11.	5	5	5	5	5	5	5	5	5	5	5
12.	5	4	3	5	5	5	5	5	5	5	4.7
13.	4	4	5	4	4	3	4	4	4	4	4
14.	5	4	4	5	5	4	4	5	3	4	4.3
15.	5	4	4	4	4	4	5	4	4	4	4.2
16.	4	4	3	3	3	4	3	3	3	3	3.2
17.	3	3	3	3	3	3	3	3	3	3	3
18.	4	4	3	3	2	3	3	4	3	3	3.2

19.	5	4	3	5	5	5	4	2	2	2	3.7
20.	4	3	2	2	4	5	4	5	4	3	3.6
Total											**79.8**
Average											**3.99**

The data in the table above was taken from 20 respondents with a percentage of 80% Students, 5% Students, 5% Private Employees. 5% are unemployed, and 5% do not respond. After processing, the data has a total score of 79.8 points, with an average of 3.96 points from the overall results. If concluded, visitors feel quite satisfied with the application's performance.

Application Implementation

Based on the results of the data obtained through the questionnaire provided, both applications run well and are easy to use for anyone, especially for students and workers who are also visitors to SME Shops. Both applications have a fairly high average value, so if concluded Advergame has succeeded in being used as a new promotional medium for SME Shops.

According to the results of the questionnaire data that has been accumulated, how to play in video games is easy to understand. In addition, players judge that the point system given by the video game is in accordance with the challenges given. This can make players feel challenged and play the game more often so that more points can be obtained to redeem bigger promos.

Meanwhile, from the employee's side, this application is easy to operate. So that for employees who still do not understand technology, they can immediately adjust and not be too confusing in addition to using the application, employees can also easily confirm if there are customers who want to redeem their promos.

Discussion and Theoretical Implications

The usability testing results reveal strong user acceptance, with the admin application scoring 4.48/5.0 and the customer application scoring 3.96/5.0, both exceeding the 3.0 threshold. These findings align with previous advergame research demonstrating high engagement potential (Marti-Parreno et al., 2022). The higher admin score suggests intuitive interface design for business operations, while the customer score indicates effective gamification for target users. These results support the theoretical framework that advergames enhance brand interaction through intrinsic motivation and reward mechanisms (Terlutter & Capella, 2021).

The integration of Unity 3D and Firebase proved technically feasible and cost-effective for SME implementation. This combination addresses a gap in existing literature, which predominantly examines advergames developed by large corporations with substantial budgets. The RAD methodology enabled rapid prototyping within resource constraints, demonstrating that SMEs can adopt advergame strategies without prohibitive investment. This finding has practical implications for the broader SME sector seeking digital marketing innovations.

However, this study has several limitations that must be acknowledged. First, the sample size (n=30) is relatively small and limited to one geographic location, which may affect

generalizability. Second, the short implementation period did not allow for longitudinal assessment of sustained engagement or actual sales impact. Third, the study focused solely on restaurant visitors, potentially missing insights from non-visitors or online-only audiences. Future research should address these limitations through larger-scale studies, extended observation periods, and diverse SME contexts. Additionally, comparative studies examining advergame effectiveness against other digital marketing strategies (social media advertising, influencer marketing) would provide valuable insights for SME marketing decision-making.

CONCLUSION

The research indicates that advergames significantly boost visitor interest in advertisements, particularly when paired with an appropriately chosen video game, enhancing engagement rates. For restaurant owners, advergames not only stimulate customer curiosity and participation in promotions but also help manage promotional offers to align with available stock, optimizing inventory control. Future research could explore the long-term effects of different types of advergames on consumer behavior and analyze how personalized or interactive game elements further influence promotional success and stock management efficiency.

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