อิทธิพลของเครื่องมือการตลาดดิจิทัล คิวอาร์โค้ดแบบคู่ และ เทคโนโลยี AR ในแอปพลิเคชั่น ที่ส่งผลต่อความพึงพอใจของลูกค้าด้านคุณภาพสำหรับพิพิธภัณฑ์ของเล่นในประเทศไทย

The Impact of Dual QR Code and Augmented Reality in Interactive Application as a Digital Marketing Tool on Customer Satisfaction of Quality for the Toy Museum in Thailand

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บทคัดย่อ

พิพิธภัณฑ์ของเล่นมีความสำคัญในการมอบความรู้และสร้างความสุขให้แก่ประชาชน ฉะนั้นการรับรองความทันสมัยและคุณภาพที่ดี เป็นปัจจัยที่สำคัญอย่างมากเพื่อดึงดูดลูกค้าและเพิ่มความพึงพอใจ วัตถุประสงค์ของบทความวิจัยนี้คือการศึกษาอิทธิพลของเครื่องมือการตลาดดิจิทัลที่ปรับปรุงใหม่ต่อความพึงพอใจของลูกค้าด้านคุณภาพ โดยใช้ คิวอาร์โค้ดคู่ และ Augmented Reality ในการสร้างแอปพลิเคชั่นใหม่เพื่อเป็นเครื่องมือสื่อสารการตลาดซึ่งเรียกว่าเครื่องมือทางการตลาดดิจิทัล ในงานวิจัยนี้ได้มีการทำการทดลองที่พิพิธภัณฑ์ของเล่นที่ตั้งอยู่ในประเทศไทย ประชากรที่ใช้ในการศึกษานี้คือ 10,000 คนในปี 2562 ถึงมกราคม 2563 กลุ่มตัวอย่างคือผู้ใช้ 400 คนที่ใช้แอปพลิเคชั่นรุ่นใหม่เป็นครั้งแรกที่พิพิธภัณฑ์ของเล่น ในการวิจัยได้ใช้แบบสอบถามเป็นวิธีการรวบรวมข้อมูลและวัดความพึงพอใจของลูกค้าในแง่ของคุณภาพของการใช้งานซึ่งเป็นสถิติเชิงพรรณนาประกอบด้วยค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน และ การทดสอบสมมติฐานสำหรับค่าเฉลี่ยสองตัวอย่างเพื่อระบุความแตกต่างในความพึงพอใจของลูกค้าระหว่างแอปพลิเคชั่นรุ่นเก่าและใหม่ ผลการวิจัยพบว่าความพึงพอใจของลูกค้าต่อคุณภาพของเครื่องมือดิจิทัลแบบใหม่สูงมากและเพิ่มขึ้นจากเก่า ดังนั้นเครื่องมือการตลาดดิจิทัลที่นำเสนอสามารถนำมาใช้อย่างมีประสิทธิภาพเพื่อดึงดูดผู้เข้าชมมากขึ้นและอาจนำไปใช้กับพิพิธภัณฑ์ประเภทอื่นๆได้ ในขณะที่ประเทศไทยกำลังเติบโตในด้านดิจิทัล การใช้เทคโนโลยีในศตวรรษที่ 21 เพื่อการบริการอย่างพิพิธภัณฑ์สามารถทำให้ลูกค้าได้รับประสบการณ์ที่น่าสนใจ ในขณะที่ยังได้รับความรู้เพิ่มเติมอีกด้วย

คำสำคัญ: เครื่องมือทางการตลาดดิจิทัล, พิพิธภัณฑ์ของเล่น, ประเทศไทย, คิวอาร์โค้ดคู่, Augmented Reality, ความพึงพอใจด้านคุณภาพ

Abstract

The Toy Museum has a vital purpose to create happiness for the public and as well as to spread valuable knowledge on the history of toys. Thus, it is extremely important to ensure a modern, good quality and interactive model that would satisfy and attract customers. This research is focused on utilizing the Dual QR Code as a means of a marketing communication tool called the digital marketing tool. The purpose is to examine the impact of the newly developed digital marketing tool or the interactive application on customer satisfaction. In conducting observational studies at the Toy museum of the private sector, located in Thailand, the population used in this study was 10,000 visitors in 2019-January 2020. The sample group is the 400 users who used the newer version of the application for the first time at the Toy Museum. In this research, the tools used were the interactive application itself acting as the digital marketing tool (Dual QR code and AR) and questionnaires in it, which is how the data was collected along with systematic random sampling. The measurement of customer satisfaction in terms of the quality of the application were descriptive statistics, consisting of the mean, standard deviation and as well as hypothesis testing for two-sample means to identify the difference in customer satisfaction between the old and new version of the application. The result found from this research was that there has been a significant (P value < 0.001) improvement in customer's satisfaction on the quality of the new tool. Hence, the digital marketing tool presented can be effectively used to attract more visitors and may be applicable to other types of museums.

Keywords: Digital marketing tools, Toy Museums, Thailand, Dual QR Code, Augmented Reality, Customer Satisfaction

1. Introduction and Literature Review

In today's world, technology plays a big part, hence the name Thailand 4.0 where the world becomes more digitized. Digital marketing tools are extremely prevalent in attracting people as well as to compete effectively with other businesses. For the tool to be effective and attractive, customer satisfaction in its quality must be emphasized on, as well as the uniqueness of the tool. In this research, the main focus is on customer satisfaction in the quality of the digital marketing tool or the new interactive application itself. There are various and more than thousands of museums in Thailand. Despite Thailand being a famous world-class tourism country that attracts visitors internationally, museums in Thailand barely attract attention compared to other places. This issue should be highlighted because museums showcase Thai tradition and culture that many tourists would enjoy if they considered visiting. From this, there is a lack of attractiveness and customer satisfaction in many Thai museums. Hence, traditional marketing is not enough to compete with other businesses, which means there should be an implementation of unique and effective marketing tools that emphasizes current technologies. [1] This research focuses specifically on the Toy Museum named "Tooney Toy Museum." The objective of this research is to examine how customer satisfaction is affected by the digital marketing tool through the implementation of the Dual QR Code and Augmented Reality (AR) in the interactive application. This also acts as a medium in providing knowledge and information to customers at the Toy Museum with the largest collection and variety of toys in Thailand.

The literature review of this research comprises of information and concepts related to the Toy Museum, digital marketing tool, the technology QR Code, Augmented Reality (AR), software algorithm, and customer satisfaction. First of all, a digital marketing is using digital technology to advertise or market a product or service, usually through the internet but as well as other digital mediums like mobile phones. [2] Utilizing technology to market a product or service is extremely effective because although the investment may be relatively high, it is worth the revenue that technologies are expected to bring to businesses. [3] More specifically, AR applications can improve the brand's appearance and act as an effective marketing tool according to many studies. [4,5] AR technology aims to supplement real world experiences through an interactive and unique way in presenting information for customers. [6] This research will focus on in-store technology and system as an effective digital tool to market the Toy Museum and increase customer satisfaction. In-store technologies, which include AR, rank high in customer convenience and social presence; hence, they enhance the service being offered to customers and influence buying behaviors. [7] For the Toy Museum, this would potentially mean more sales and profits with the implementation of AR application.

In this case, the service being presented is the entertainment and knowledge received from buying a ticket to visit the Toy Museum. In order to promote this service, the digital marketing tool employed was an updated version of the interactive application that now includes the Dual QR Code and Augmented Reality. QR Code stands for Quick Response Code, a two-dimensional bar code. The technology was released in 1994 by DENSO WAVE to the public where everyone could use it freely. The increasing trend of using the QR Code was due to the marketing of the QR code-reading feature on mobile phones. The sheer simplicity has encouraged

the general public to accept the usage of QR codes. [8] The QR Code has been improved upon as an idea of using Dual QR Code was brought up during the brainstorming stage of discussing how to improve the interactive application or the digital marketing tool. The Dual QR Code comprises of two separate QR Codes that can be scanned once they are put side by side, just like a puzzle. Once the visitor buys an entrance ticket, they will get a postcard with a QR Code. Then, the user can scan the Dual QR Code by using the application to pair up the QR Code on their postcard and another QR Code; then, an Augmented Reality element will pop up. There are six QR Codes in total in which each is at six different locations with different collection of toys. The Augmented Reality element is meant to show colorful visuals and play a video, available in both Thai and English, and give knowledge or historical facts about the toy or collection being shown.

Augmented reality is a progressive and advanced technology where computer graphics get overlaid on the real world. AR technology is widespread with various applications in areas like gaming, entertainment, medical, advertisement etc. [9] An AR system mainly comprises of a scene generator, a tracking system and a display. The software or device, a scene generator, renders the scene. [10] The tracking system is a vital component but also a problem for the AR, its purpose is to align the virtual elements with the real world; however, if the registration is not accurate, the AR generated may not be as compelling and accurately functional. Thus, an ideal tracking system should place the rendered virtual elements in the correct positions relative to the real world. As for the display, the devices are commonly the Head Mounted Displays (HMD), smartphones or tablets, projectors and holograms. AR experiences can be hosted via smartphones, which is easily accessible since people tend to have smartphones anyways. [11] According to a study published on the Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior [12], Augmented Reality creates customer satisfaction prior buying, making purchase decisions and when they evaluate the product. Hence, this shows how AR in itself not only improves the product or service but also enhances the entire consumer experience.

As for software algorithm, it means the sequence of processing or set of procedures with the goal to solve a problem through programming. In this research, software algorithms were used to create the interactive application with the goal to attract, entertain and spread knowledge about toys for the visitors; in short, to increase customer satisfaction. Customer satisfaction is the positive feeling in a customer towards a product or service when their expectations are met, or the benefits exceed them. Benefits can be in terms of their positive emotions or functional benefits. [13] The old version of the application was not as interactive as it only prompted users to scan one QR Code per station and play games in the application (Figure 1); the old version also lacks many features unlike the new version (Table 1). The main core of this research is to analyze and ensure higher customer satisfaction in the quality of the digital marketing tool, which is the new interactive application with Dual QR code and Augmented Reality (Figure 2). The new interactive application is developed by using software algorithms and programming language called Unity. The Dual QR Code component is an innovative concept developed during the brainstorming stage in how to improve the application. The corner points of each half of the QR Code, once put side-by-side, is programmed to coordinate together and once scanned, the Augmented Reality element will pop up.

Figure 1 – Old Version of Museum Application

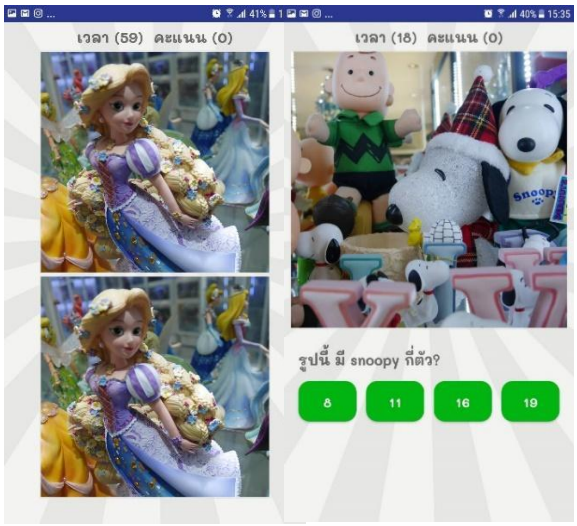


Figure 2 – New Version of Museum Application

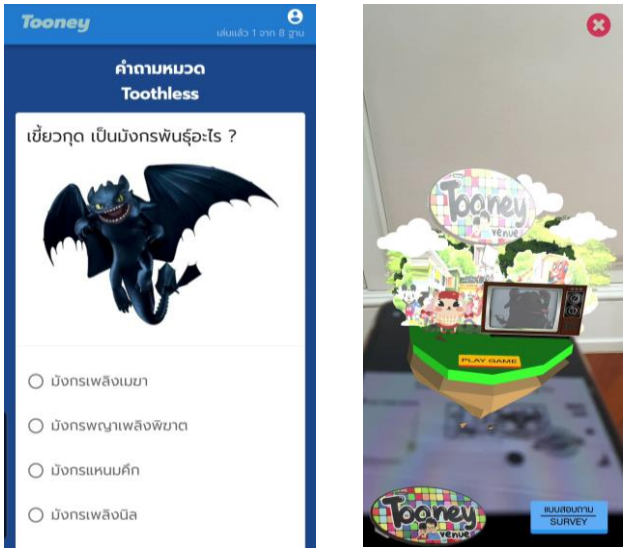


Table 1 – Comparison between Old Version and New Version of Museum Application

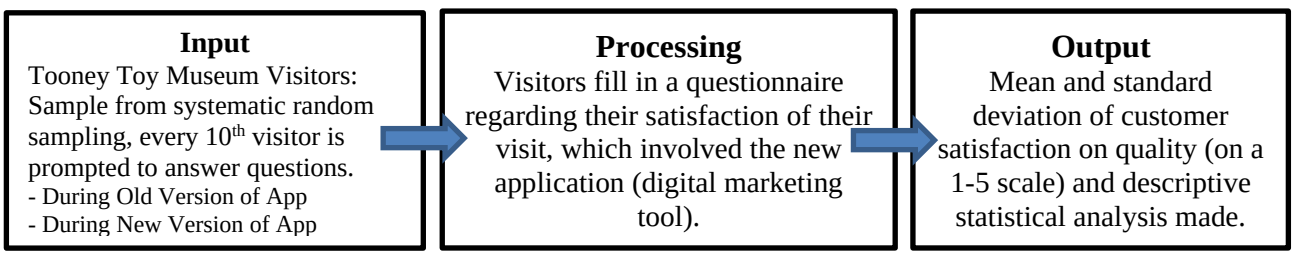
Old Version of Museum Application	New Version of Museum Application
• Registration system • One QR Code per station • Games and points system	• Registration system • Dual QR Code per station • Games and points system • Augmented Reality • Educational videos about the station • Educational quizzes about the station

2. Methods and Materials

2.1 Scope of the research

The type of digital marketing tool and strategy utilized at the Toy Museum falls under in-store technologies, which specifically implements Dual QR Codes and AR application. Tooney Toy Museum visitors are the population of this research. Data on customer satisfaction in quality was collected during March 2019-June 2019 for visitors who used the old application with QR Code while data was collected during October 2019-January 2020 for new visitors that used the new application.

2.2 Research Conceptual Framework



2.2 Materials

The materials used in this study comprised of tangible elements and the software of the application itself that act as a digital marketing tool or strategy. As mentioned in the introduction, the application needs QR codes for the AR co mponent to pop up. The first half of the QR code is on the postcard (Figure 3), which acts like a ticket for the visitor. In an example station for Toy Story (Figure 4), the QR code is placed on a platform for convenience in scanning. The other halves of the QR code are placed on 6 different toy stations for the visitors to align their postcard with (Figure 5) and scan by using the application (Figure 6). Questionnaires are also used to examine customer satisfaction by letting them rate statements on a scale from 1-5 via a Google Form, which is standardized from the last research on the older application.

Figure 3 – Visitor Postcard Ticket with QR Code

Figure 4 – Example Toy Station with QR Code

Figure 5 – Dual QR Code

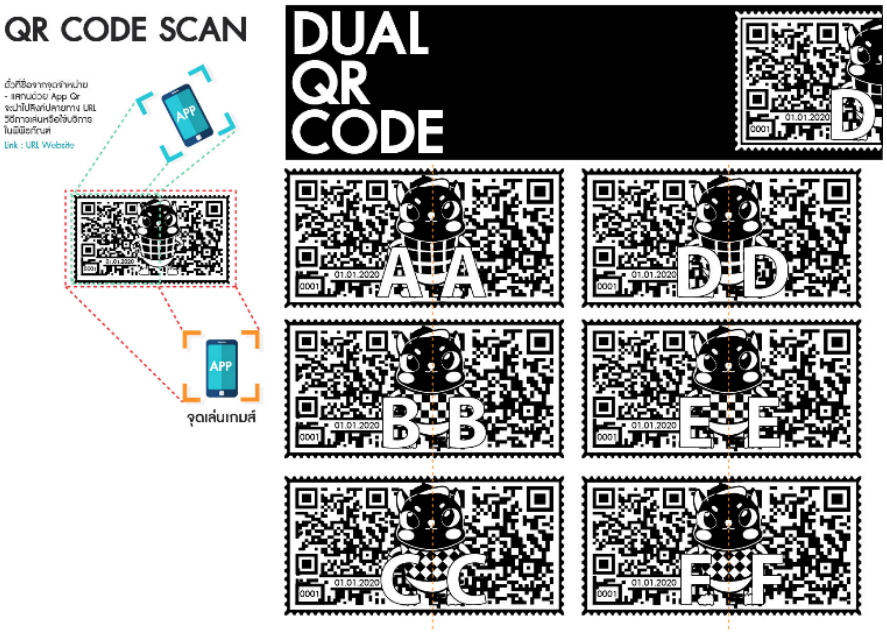
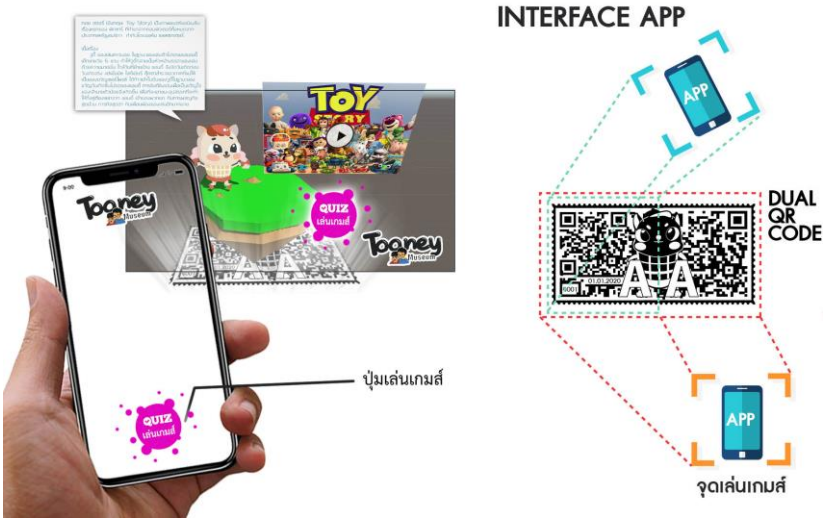


Figure 6 – The Interactive Tooney Toy Museum Application with Augmented Reality



2.3 Objectives

- To study the impact of implementing the Dual QR Code and Augmented Reality as the digital marketing tool on customer satisfaction of quality at the Toy Museum.
- To examine whether the new application with Dual QR Code and Augmented Reality has led to an increase in customer satisfaction of quality.

2.4 Procedure

This research is conducted at Tooney Toy Museum located at Soi Srisamarn 8, Ban Mai Subdistrict, Pak Kret District, Nonthaburi 11120. The population of this research are the visitors of the Tooney Toy Museum from 2019 to January 2020, separated into two samples: visitors during the old version of the interactive application (March-September 2019) and the visitors during the new version (October 2019-January 2020). The sample size was picked through much consideration in order to ensure accurate results. The sample size was calculated by Krejcie and Morgan's table [9], in which a population of 10,000 people would need more than 370 people. Thus, the sample was decided to be 400 people for simplicity.

The procedure of the research is that as people visit the Toy Museum, the staff members at the registration counter will give the postcard ticket with the QR code and present the application so the visitors can download it. Then, the staffs will give a short instruction about the new version of the application and demonstrate how to use the Dual QR Code and AR feature. At the end of the Toy Museum experience, the visitor will then answer the questionnaire. Visitors at the Tooney Toy Museum, or the population of interest for this research, will be randomly selected using the systematic sampling method due to the large population. Data on customer satisfaction is systematically collected for every 10^{th} person, which is then put into the sample group for visitors that experienced using the new digital marketing tool. With this randomization, it allows for groups to be validly compared (visitors during old and new application) and valid statistical analysis can be

made to examine the impact of new digital marketing tool on customer satisfaction compared to the old digital marketing tool. The questionnaire used to collect data on customer satisfaction consists of personal (name, phone number, email address) and four main questions related to the quality of the application. The responses to the questionnaire are on a 1-5 scale, 5 being strongly agree while 1 is strongly disagree. They are then averaged into the mean and the standard deviation is calculated. The statistical method used was hypothesis testing of two sample means. The first sample comprised of 400 visitors from the previous research paper that used the old version of the interactive application; the responses gathered were by the same method of collecting data from visitors through an online form. [14] This sample is then compared with the second sample of visitors who used the new version of the application to examine the difference between the two means of customer satisfaction in the quality of the application. Through hypothesis testing, a null and an alternative hypothesis is presented, and calculations of the t-statistic, Cohen's d effect size and p-value are made in section 3. The results of this research may lead to commercial applications as well as potential applications to other museum sectors.

3. Result and Discussion

Table 1 Mean ($\bar{X}$) and S.D. of Customer Satisfaction in Quality of Old Version of Interactive Application with QR Code

Satisfaction in application's quality	$\overline{X}$	S.D.	Level of satisfaction in quality
Q1	4.29	0.67	High
Q2	4.16	0.73	High
Q3	4.02	0.71	High
Q4	4.13	0.69	High
Total	4.15	0.70	High

Q1: The process in using the application is simple
Q2: There is a clear order and good understanding in using the application
Q3: The registration process is easy
Q4: The application has a good, attractive and modern appearance

Key: 1 = Strongly Disagree, 5 = Strongly Agree

Table 1 presents the mean of 4.15 and standard deviation of 0.7 of customer satisfaction on a 1-5 scale of the old version of the digital marketing tool. Customer satisfaction in the registration process is the lowest at 4.02.

Table 2 Mean ($\bar{X}$) and S.D. of Customer Satisfaction in Quality of New Version of Interactive Application with Dual QR Code and Augmented Reality

Satisfaction in application's quality	$\bar{X}$	S.D.	Level of satisfaction in quality
Q1	4.58	0.63	Very high
Q2	4.56	0.65	Very high
Q3	4.57	0.67	Very high
Q4	4.63	0.61	Very high
Total	4.59	0.64	Very high

As seen from Table 2, overall, the level of customer satisfaction in the quality of the digital marketing tool (the interactive application) with the Dual QR Code is very high at 4.59 as well as having a low standard deviation at 0.64.

Case Processing Summary

		N	%
Cases	Valid	400	100.0
	Excluded	0	0.0
	Total	400	100.0

Reliability Statistics

Cronbach's Alpha	N of items
0.923	4

By calculating the questionnaire's reliability or internal consistency, it is evident that the scale used is extremely reliable as 0.923 is a lot more than 0.7, which is the acceptable value. There is 0.148 error variance, which indicates low variability in data collected for customer satisfaction in the new application.

Two-Sample Hypothesis Testing

Significance Level: 0.01 (99% Confidence Level)

Null hypothesis: $\mu_1 - \mu_2 = 0$ There is no difference in customer satisfaction in quality between the old and new version of the interactive application

Alternative hypothesis: $\mu_1 - \mu_2 < 0$ There is a significant difference in customer satisfaction in quality between the old and new version of the interactive application. The new version has a higher mean customer satisfaction than the old version.

μ_1 = the true mean customer satisfaction in quality of old version of the interactive application

μ_2 = the true mean customer satisfaction in quality of new version of the interactive application

Conditions for Two-Sample t test for population mean

- Both samples are independent and random.
- 10% Condition met: 400 ≤ 1/10(10,000)
- Large sample sizes, both are more than 30, thus, according to the Central Limit Theorem, both distributions are approximately normal, and we can proceed with the hypothesis test.

Calculations

$$t = \frac{(\bar{x}1-\bar{x}2)}{\sqrt{\frac{{S_1}^2}{n_1}+\frac{{S_2}^2}{n_2}}} = \frac{(4.15-4.59)}{\sqrt{\frac{0.7^2}{400}+\frac{0.64^2}{400}}} = -9.28$$

Degrees of freedom = 399

Effect Size Cohen's d = (4.59 - 4.15) / 0.670671 = 0.66

P value < 0.001. The large effect size indicates that the difference is important. Also, since the p-value is less than 0.01, we reject the null hypothesis that there's no difference between the means and conclude that there is convincing evidence that a statistically significant difference does exist in the mean customer satisfaction in quality between old and new version of the interactive application.

4. Conclusion

The research has found that customer satisfaction on the quality of the new digital marketing tool, the Dual QR Code along with Augmented Reality, at the Toy Museum is extremely high and has increased significantly from the previous tool. Hence, the null hypothesis is rejected and the alternative hypothesis is accepted. In reference to the questionnaire, the results have indicated very high satisfaction in terms of the simplicity, clear sequencing, easy process and appearance of the interactive application. Moreover, the customer satisfaction in terms of the quality of the application has evidently increased from the old application due to the new features of Dual QR Code and Augmented Reality. Results from this research are concurrent with other studies that indicate how AR can impact customer satisfaction and positivizes their perception of the business, acting as a viable marketing strategy. [4,5] Moreover, as previously mentioned in the literature review, Augmented Reality tends to appeal to customers, making them experience pleasure and fun [7]. The impact of implementing the new digital marketing tools is it strengthens the image of Tooney Toy Museum as a modern and technologically-advanced business. The marketing tool also persuades more customers to visit again and potentially influences word-of-mouth due to the uniqueness of the in-store technologies.

5. Implications

The technological system presented in this research may be applied in other types of museums or business sectors as the results have shown very high customer satisfaction with Dual QR Code and Augmented Reality being implemented. Other types of museums can create a similar digital-based system by placing half of the QR Codes on items being exhibited and having the other half on the visitor’s ticket to

create interactivity in for the customer's experience. Then, other museums can create their own uniquely-themed Augmented Reality with informative videos and interactive games that will pop up once Dual QR Codes are scanned. However, some improvement and further development may be needed for the order and understanding of the application (Q2) since it has the lowest customer satisfaction value compared to other features. Hence, this research at the Toy Museum has great implications and the developed digital marketing tool has great potential to be beneficially applied elsewhere.

As a recommendation to Tooney Toy Museum, possibly in the future, the business could implement an online version or trial of one toy station using AR where potential customers can enjoy trying out the application wherever they are. It is also important to note that although investment is relatively high for AR, in the long term, the application can be easily updated with newer content and details. Customers from home can possibly subscribe to the application and this unlocks the great potential of a digital museum while many customers may also want to visit the museum in real life later on. As the COVID-19 situation will be with us for a period of time, it is important for physical businesses to be able to adapt by using digital marketing tools and formulate strategies to maintain profitability and customer satisfaction.

6. Acknowledgements

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