

## Augmented reality in customer experience: systematic review

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### Article Info

#### Article history:

Received Jan 31, 2024

Revised May 04, 2024

Accepted May 26, 2024

#### Keywords:

Attitude

Augmented reality

Consumer experience

Customer experience

Customer satisfaction

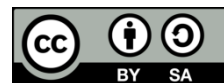
Interactivity

Systematic review

### ABSTRACT

Augmented reality (AR) is an emerging technology that offers the opportunity to explore a new way of shopping in the customer experience, showcasing its benefits, such as the superimposition of virtual elements in a physical environment or the high degree of interactivity provided by this technology. Despite its great potential to satisfy customer needs, the evaluation of the customer experience has not been fully studied. The main of this study is to identify the constructs that influence customer experience using the systematic review technique. A total of 88 studies published between 2016 and 2021, which relate to customer experience, were identified. Relevant information, such as the definitions of AR and customer experience, and the constructs that various authors use to assess customer experience, was extracted. The results of the review indicate that five fundamental constructs—attitude, interactivity, customer satisfaction, purchase intention, and hedonic value—are used to assess customer experience. These results contribute to a better understanding of the customer experience with AR.

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## 1. INTRODUCTION

Augmented reality (AR), as a general concept, is a technology that integrates virtual information to enhance a specific reality [1] and offers a new perspective on positioning products and developing image creation in the user's mind [2]. AR provides several attributes, such as enhanced visual experience and the ability to control information, making it a powerful tool to capture and enhance user experiences [3]. Technological progress and its significant impact on consumers have generated additional value in existing AR applications [4]. AR finds applications in various fields, including e-commerce, retail [5], tourism [6], [7], education [8], marketing [9], hospitality [10], and more. In sales, AR applications can aid customers in making purchase decisions about a product in special technological products [11]. In the tourism sector, AR applications allow consumers to obtain additional information from physically visited sites and provide a virtual layer between the physical environment and the user [7]. In the education sector, AR-based learning is useful for courses that include complex topics [8]. In the marketing sector, AR stimulates the presence of advertisements, generating affective intentions and curiosity about the product [12]. Some companies have placed their bets on AR technology. For instance, Alibaba invested over \$200 million in 2016 to boost AR development, establishing AR and virtual reality labs and introducing some of the first three-dimensional (3D) products in its online catalogue [13]. IKEA is another example, enabling its customers to place products in virtual catalogues, providing them with a real-world perspective and the ability to customise their homes with virtual furniture. Similarly, companies like Ray-Ban and Sephora utilise AR to offer magic mirrors, allowing customers to virtually try on sunglasses or makeup [14]. However, the implementation of AR has brought about

some customer safety concerns. For example, customers are uncertain whether the products will fit appropriately in their environment [15]. To address this issue, a clear benefit of AR is that it allows brands or companies to access customers' home spaces, thereby facilitating an improved customer experience when making online purchases [16]. This is especially crucial for retail companies, as they need to examine and enhance their consumer experience to derive benefits in influencing purchasing decisions.

Complementing the objectives of companies adopting AR, consumers perceive AR as an immersive, realistic, and innovative technology [17]. Another crucial factor enhancing the positive customer experience is the utilitarian value, encompassing digitalism features, decorative benefits, or tactile advantages [18]. AR can improve marketing initiatives to increase brand value [19] because marketers use AR to place brand-related information in the consumer's physical context to capture their attention [20]. The ability to capture customer attention is influenced by various characteristics or constructs that impact behavioural intention. Positive behavioural intention leads to return visits to the shop where the product was purchased, benefiting recommendations and contributing to a positive image of any organisation aiming to attract more customers [21]. Moreover, achieving an "optimal experience" is essential, encompassing positive outcomes like pleasure and enjoyment while eliminating negative outcomes such as wasted time [22]. AR enables prospective buyers to overlay virtual information, reducing cognitive load and fostering a positive attitude towards a product.

In its early days, AR gained significant relevance as a newly discovered technology due to its profound impact on sensory evaluation and innovative aspects [23]. Over time, AR has continuously evolved, largely thanks to the technological advancements in smartphones [24]. This technology enables the seamless combination of the real and virtual worlds, introducing 3D objects into our environment [25]. It further enhances the consumer and retailer experience by fostering face-to-face interactions [26]. AR not only offers a novel experience but also facilitates vivid visualisation through the superimposition of 3D images onto our graphical surroundings [27]. The benefits of AR include increased hedonic values, enhanced utility aspects, greater satisfaction, and improved consumer decision-making processes [18]. Despite its advantages, AR does present different levels used to describe the complexity of its application [28] such as the marker identification process and the content creation itself [29]. AR technology has found applications in various sectors. In the tourism industry, AR applications are targeted at city councils, museums, exhibitions, restaurants, theatre offices, and more [30]. In the entertainment sector, AR is prominent in video games, allowing the superimposition of images or graphics onto the real world [30]. A well-known example is the Pokemon Go app, which captivates users by enabling them to interact with the real world while exploring the virtual Pokemon universe [31]. AR has also found applications in the commercial sector, particularly in furniture visualisation. Users can use AR to intuitively customise furniture, enhancing their shopping experience [32]. Companies like Shopify have demonstrated that AR increases interactivity by 94%, leading to benefits in customer experience and facilitating the shopping process through smartphones [33]. QR codes have been utilised to trigger animations, allowing for unique brand marketing strategies to engage potential users [34].

Customer experience refers to the set of stimuli or psychological feelings that the customer generates when interacting with the product, enhancing the quality of the consumer's search experiences [35]. It encompasses pre-purchase, purchase, and post-purchase interactions [36]. Customers express their experiences through emotions, which can be influenced by various factors such as the physical surroundings, satisfaction, and more. Several metrics have been developed to assess customer experience, such as the experiential value [37], brand experience scale [38], quality of experience scale, customer experience index [36], quality of service experience scale [39], and retail customer experience scale [40]. The spatial presence created by AR played a vital role in enhancing the overall customer experience [41]. Similarly, AR is a significant trend in marketing [25]. It has also been incorporated into mobile applications [42], allowing users to select and visualise makeup superimposed on their faces using smartphone camera functions [43]. Research is needed to enable the target audience to identify and analyse the factors or characteristics that contribute to a comprehensive understanding of the customer experience from a systematic perspective [13]. This article aims to analyse the most commonly used constructs in customer experience utilising AR, based on a systematic literature review. By identifying these frequently employed constructs, the article offers practitioners valuable insights to develop AR proposals that effectively integrate the identified elements. Consequently, it is a valuable resource for practitioners seeking information on client experience with AR. Additionally, the research contributes to the overall knowledge and understanding of the primary constructs currently employed in assessing customer experience.

This article consists of four sections including the introduction. The systematic review method used in this study is presented in section 2. In section 3, the research outcomes addressing the research questions (RQs) are presented and discussed. Finally, section 4 outlines the conclusions drawn from the study.

## 2. METHOD

The systematic review process is based on Kitchenham proposal [44]. This method provides specific characteristics and a sequence of steps that facilitate the synthesis of information in a practical and structured manner. It also allows for the implementation of a search strategy, enabling the researcher to identify, report, and analyse all the extracted information. To achieve this, the development of a protocol is essential, as it defines a sequential, systematic, and auditable procedure. The process consists of the following steps: i) establish RQs, ii) development of the review protocol, iii) selection of primary studies, iv) quality assessment of the studies, v) data extraction and monitoring, and vi) synthesis of the information [44]. The synthesis of information is presented in the results section. Each stage is elaborated in detail in the subsequent sections of the review. The purpose of this research is to address and fill the gaps present in previous studies concerning the evaluation of customer experience using AR. The primary objective of this article is to identify and analyse the most utilised constructs in customer experience with AR. To achieve this objective, the following RQ is posed:

– RQ1=What constructs are currently being used in customer experience with AR?

To assess specific constructs, three research sub-questions were formulated:

– RQ1.1=Does AR provide benefits in terms of hedonic values to customers?

– RQ1.2=Is AR perceived as an interactive and innovative technology by customers?

– RQ1.3=Is AR considered a technology capable of influencing customers' purchase intentions?

The development of the review protocol ensures a structured and systematic approach with specific strategies to analyse and synthesise the gathered information. Figure 1 presents the sequence of steps in the protocol. The first step involves establishing a research topic and formulating the RQs. Subsequently, the article selection procedure is defined, which includes the following steps: i) selecting the article extraction database, ii) defining the search strings, iii) setting the inclusion and exclusion criteria, and iv) implementing the primary article selection procedure. By executing these steps, the selected primary articles are identified. Following this, quality criteria are established, and a data extraction format is created using spreadsheets and word processors to organise the abstract information.

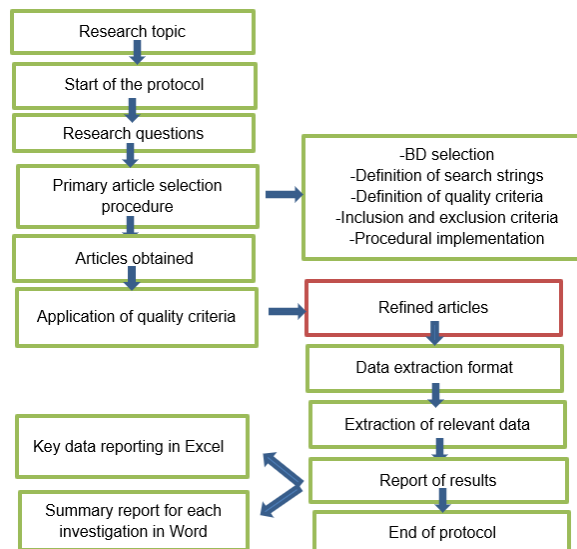


Figure 1. Steps in conducting a systematic literature review

### 2.1. Selection of primary studies

In this phase, the focus is on identifying the primary articles that are relevant to the study. The process consists of the following steps: i) identifying sources of articles, ii) constructing and executing keywords, iii) elaborating the search string, and iv) identifying inclusion and exclusion criteria. It is necessary to conduct a search process in recognised databases as they will enable the extraction of concise and useful information to be used in the analysis of the systematic review [44]. Five databases were identified for this purpose and the construction of the search string is based on the following keywords: i) “Augmented Reality”, ii) “Customer”, iii) “Consumer”, and iv) “Experience”. Table 1 displays the identified databases along with their respective search strings.

Limiting the research by specific criteria is crucial to ensure the value and thoroughness of the analysis in the search for relevant information [44]. Four inclusion criteria have been identified, which are as follows: i) articles published within the period 2016–2021, ii) articles with statistical results, iii) articles published in journals, and iv) empirical studies. Additionally, exclusion criteria have also been identified, which include: i) non-English language articles, ii) review articles, iii) short articles, and iv) duplicate articles. The extraction of information is not solely accomplished by using information managers; it also requires the application of strategies to enhance the connection between the research topic and the search process.

These strategies are essential to filter and eliminate articles that are unrelated to the research topic. At this stage, the evaluation of the inclusion and exclusion criteria is conducted. Besides excluding articles with titles and abstracts unrelated to the research, the following steps were documented: step 1: the search string presented in Table 1 was utilised to search scientific databases, step 2: articles that matched the inclusion and exclusion criteria were identified. These articles were extracted and saved in a Google Drive repository, step 3: articles with abstracts not relevant to the research were removed, and step 4: the results obtained from each database were recorded.

Table 2 shows the articles according to the research steps. Relevant data from each of the primary articles were extracted and organised using a spreadsheet. Additionally, a summary of each article was extracted, and a link to the summary was attached to a Google Drive repository.

Table 1. Keywords and search string

Databases	Keywords	Search string
ScienceDirect, SpringerLink, Scopus, Taylor & Francis, and Wiley	KW01="Augmented Reality" KW02="Customer Experience" KW03="Consumer Experience"	((("Augmented reality") AND ("Customer experience")) OR ((("Augmented reality") AND ("Consumer experience"))))

Table 2. Articles according to research steps

Databases	Step 1	Step 2	Step 3	Step 4
ScienceDirect	494	212	60	43
SpringerLink	140	30	3	3
Wiley	146	9	3	1
Taylor & Francis	155	92	20	11
Scopus	81	68	34	30
Total				88

This assessment enables the analysis and evaluation of the selected articles in terms of their quality. It helps determine whether the research meets a minimum level of research quality. This phase involves grouping the studies and using specific questions to assess whether they meet the quality criteria. A scoring system is used to facilitate this process and identify potential differences among the primary studies. The quality questions were: i) EQ1=do the studies demonstrate a thorough discussion of the research? assessment: (Y=yes, N=no, P=partially), ii) EQ2=do the researchers examine multiple constructs to assess customer experience? assessment: (Y=5>constructs, N=0 constructs, P=5<constructs), and iii) EQ3=does the research cover all aspects of customer experience? assessment: (Y=most points on customer experience, N=no results, P=limited results). A total of 88 primary articles were extracted for the data extraction and tracking stage. From each article, relevant data was collected, including the following information: i) title of article, ii) author(s), iii) year of publication, iv) databases from where the article was sourced, v) country of research, vi) definition of AR, vii) definition of customer experience, viii) background of AR, ix) characteristics of AR and customer experience, x) type of study, xi) population under study, xii) sample, xiii) statistical techniques, xiv) collection instruments, xv) constructs, and xvi) definition of constructs.

### 3. RESULTS AND DISCUSSION

#### 3.1. Systematic review results

As a result of the systematic review process, a total of 88 primary articles were obtained. The main focus of the review was to analyse and extract information related to the definitions of AR and customer experience, as well as the constructs used to assess customer experience with AR. Figure 2 shows a significant upward trend in the number of AR-related publications from 2016 to 2021, with a particularly sharp increase in the years 2020 and 2021. This surge in AR publications during these years can be attributed to the profound impact of the COVID-19 pandemic on retail organisations and businesses worldwide. The pandemic necessitated lockdowns, social distancing measures, and restrictions on physical interactions, disrupting

traditional retail experiences and prompting the search for alternative solutions to engage customers and facilitate remote shopping experiences. A total of 88 articles were selected.

Researchers make more use of the statistical technique of structural equation modelling (SEM) because of the interrelationship of variables in an investigation. The most commonly used software includes SPSS and SmartPLS. The majority of the selected studies were conducted in the United States, totalling 19 studies. South Korea ranked second with 11 studies, followed by Germany with 9 studies. Notably, a significant number of studies have been conducted in Europe. Furthermore, it is worth mentioning that a considerable proportion of these studies have been focused on the field of e-commerce. The findings of the review indicate that a majority of the research conducted on customer experience with AR is quantitative (90.0%). This prevalence can be attributed to the need for empirical evidence and numerical data to test and measure customer experiences effectively.

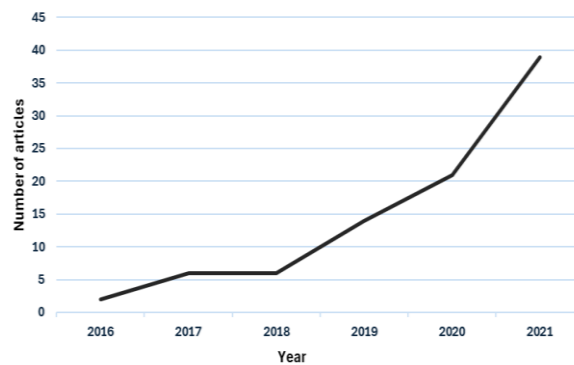


Figure 2. Trend of publications in the period 2016–2021

### 3.1.1. AR definitions

According to the literature, there are different definitions proposed for AR. Table 3 presents the definitions of AR by author. Along with the focus of each definition, such as technological, innovative, and interactive aspects.

Table 3. Definitions of AR

Author	Definition	Approach
[4]	It transforms objects and environments into the user's personal space to create personalised experiences.	Technological
[13]	Interactive tool that can modify the physical environment using virtual overlay elements.	Technological
[45]	Superimposing virtual objects on the physical world.	Technological
[46]	Visualisation of the real world while interacting with virtual objects.	Technological
[47]	Integration of a virtual product into the real consumer environment.	Technological
[48]	3D digital content that combines real and virtual images for the consumer.	Technological
[49]	Technology that allows interaction between the user and virtual objects augmented in the real world.	Technological
[50]	Coexistence of virtual objects and the real world.	Technological
[10]	Intelligent content to provide a pre-experience for customers.	News
[51]	Virtual content that is related to the product and allows information to be obtained.	News
[52]	Injection of novel and virtual information that allows for better consumer perception.	News
[24]	It provides additional value with three- and two-dimensional information to consumers about products.	News
[53]	Information provided by technology that goes straight to consumers.	News
[54]	A technological tool that allows information to be obtained on a product.	News
[1]	It provides more product information in rich 3D format.	Virtual integration
[2]	Superimpose virtual objects on the physical environment including information that allows interaction with the consumer.	Virtual integration
[3]	It allows you to create a unique and detailed view of a combined real and virtual world experience.	Virtual integration
[5]	Modern technology allows the real world to be combined with the virtual world, achieving interactivity in real time.	Virtual integration
[15]	A realistic 3D model that appears in a given location.	Virtual integration
[25]	Integration of products into virtual content that merges it with the real world.	Virtual integration
[31]	It allows the generation of personalised results for the user, achieving the integration of virtual information in the real world.	Virtual integration
[55]	Computer-simulated interactive technology that enriches the user experience by integrating additional information in the real world.	Virtual integration
[56]	Technology that enables immersive, engaging, and realistic content that enhances brand image.	Brand perception
[57]	Experimentation with audiovisual components that augment the physical reality in a given shop.	Brand perception

The findings of the study reveal that the authors' perspectives on the concept of AR is predominantly technological. Most of the authors argue that AR is an "overlay" because it enables the creation of virtual elements that are superimposed on the real world [35]. Another significant approach is the "integration" perspective, emphasising how AR allows the incorporation of new information into the real world [58]. While AR offers interaction and is considered innovative, the authors in the literature do not primarily define AR in these terms. They focus more on the technical aspects. Additionally, AR can be regarded as a technology that provides "stimuli" [1]. It is essential to note that the elements were grouped based on the information provided by the authors using our criteria.

### 3.1.2. AR characteristics

Selected studies mention the characteristics of RA. Table 4 presents the characteristics of AR. The findings of the study indicate that interactivity is one of the most relevant features [1]–[3], [14], [48], [57], [59]–[65]. Interactivity involves enabling communication between consumers and manufacturers, creating a psychological state in which customers can have their own perspective of the system they are using [1]. However, certain factors can overshadow this interactivity process. For instance, the speed of response can cause content manipulation to be impaired [2]. This variable also drives stimuli in customers, leading to high levels of participation in the customer journey and creating a new characteristic known as "Immersion" [66]. Several authors have compared the level of information that a traditional system can provide to one that uses AR, highlighting interactivity as a key feature that allows virtual inspection of the product in real time [67]. Another crucial feature that AR provides is an improved shopping experience [27]. AR can reduce uncertainty by assisting consumers in making better-informed decisions, even without considering the key factor of the "brand" of the products. This creates certainty and introduces a new effect on the online presentation of a product [43]. Likewise, AR can generate stimulation, novelty, and experiential values [49], such as communicating the advertising that a brand offers concerning the consumer experience [68]. The value of a brand enables the retention of existing customers. AR allows for a sense of ownership, as well as pleasure and enjoyment. These emotions strengthen the bond between customers and brands, enabling the creation of a positive customer experience value [69]. Finally, it should be noted that AR features enable the activation of cognitive and utilitarian functions. This means that AR provides utility to the consumer to help evaluate and differentiate one product from another [14].

Table 4. AR characteristics

Characteristics
Interactive [1]. Interactive, simultaneous, vivid, and unique [2]. Interactive, real-virtual combination, three dimensional [3]. Interactive and integrated [59]. Provides augmentation and interactivity [48]. Interactivity, successful online communication [60]. Interactive technology that displays information on products [14]. Interactive and allows the cognitive aspect to be enhanced [57]. Enables interactivity and telepresence [61]. Allows for real-time interaction and information [62]. Interactivity with synchronisation of virtual elements [63]. Interactive technology that enables virtuality [64]. Allows interaction and motivation [65].
Creation and facilitator of experiences [4]. Influencing a better shopping experience by overlapping objects [26]. It offers a novel, interactive, and vivid experience thanks to 3D images [27]. Helps to improve the customer experience [33]. Improves consumer capabilities [42]. Offers more realistic experiences [70]. Enhances experiential value [71].
Boosts confidence promotes perception [45]. Increases hedonic and utilitarian flows [18]. Augmentation that creates an immersive consumer experience [17]. Allows users to be immersed [46]. Magnification capacity [53].
Provides ownership and love for the brand [13]. Provides fun [72]. Proportion of affective and hedonic tools [73].
Combines interactive and real elements [35]. Combines the real world with the virtual world by allowing product testing [43].
Combination of realistic 3D models [74].
Media characteristics and experiential value [25]. Displays stimulation characteristics [49].
Fun, promotional, interactive, content creation [34]. Immersion and knowledge [75].
Provides additional information for the purchasing environment [32]. Provides additional information on services and products [76].
Benefits the customer by enabling the purchase of an interactive product [24].
Ability to overlay virtual environments [5]. Accurate virtual image recognition [31].
Allows processing and understanding of a stimulus [77].
Integration of virtual content, interaction with content [78].
Improving consumers' evaluation of technologies [79].
Creative and allows decision making [80].
Effective in improving behavioural, cognitive ability, emotional control [81].
Positive customer relations [54].
Modality, synchronous meaning and processing [82].
Transforming digital content [83].
Allows for free exploration of risk [84].
Need to accommodate and perceived immensity [9].
Enables personality in shopping [85].
It allows for virtuality, superimposition, alignment, and technological activation [86].
Serves as a marketing tool [87].
Helps the client's self-esteem [52].
Allows advertising with respect to trust and purchase intention [68].
Allows for utility, novelty, distraction, and entertainment [51].
Aesthetics, promotes cognitive consequences [6].

### 3.1.3. Customer experience definitions

The definitions used by the authors for customer experience were also reviewed. Table 5 presents some definitions proposed by the authors to capture the essence of customer experience. The definition of customer experience is not standardized.

Table 5. Definitions of customer experience

Definition
Perception of useful information and enjoyment influences consumer satisfaction with their experience [2].
Set of behavioural and cognitive elements that affect the intention to use the brand in the future [3].
Product learning by connecting abstract facts to real scenarios through physical interaction [13].
Consumers' perception of the possibility of interacting with the product in an immersive way [14].
Behaviour of internal processes in consumer purchases [60].
Customer stages in the before, during, and after of the entire customer journey in the customer experience [10].
Stimuli the consumer feels in the product experience [31].
Perceived personalisation and its effects by an application on customer experience [41].
User perception through the type of information and the increased environment that even allows the consumer to have the willingness to pay more [53].
Consumer sentiment that allows for an enhanced consumer experience by including additional entertainment and information factors [67].
Consumer perception of the use of products in retail environments [45].
Effect of product attribute information to consumers affecting consumer decision making [25].
Participation in the process of co-creation and visualisation of the perceived value of a product or application [4].
Emotional characteristics in online shopping [48].
Psychological influence of consumers enabling a flow state in the context of their product experience [88].
The perspective of a customer journey that aims to improve their psychological ownership prior to purchase [72].
Combination of aesthetic, entertainment, and emotional experiences that enable positive user effects [81].
Sentiments and interactivity that improve the purchasing decision [89].
A differentiated value that provides innovative and efficient services to consumers [73].
Stage of processing mental images that help customers to make decisions [83].
Subjective assessment of the customer allowing for better controlled decision making [90].
Perceptions of customers who benefit from affective and enticing brand impulses [91].
Conversion of the traditional experience into an experience of itself with changing cognitive aspects [24].

The findings show that definitions of customer experience are cognitively encompassed. This means that most think of it as an abstract feeling that serves as a response to hedonic stimuli provided by the brand or company to the consumer [86]. Another key aspect is the competitive positioning that can be achieved as a benefit to a brand in the customer experience, allowing virtual elements to coexist with the real world, achieving additional benefits that stimulate the physical and affective condition of the customer [2]. Customer experience can also be understood as an evaluation and experimentation of a product to validate for themselves whether a product or service meets the requirements to achieve their satisfaction and compliance with the purchase [31]. In addition to that, it is also defined as a construct mainly on the cognitive, affective, behavioural, sensory, and psychological emotions that the customer or a person feels in the journey of purchase [72].

### 3.1.4. Customer experience constructs

A total of 97 constructs were collected in the research. Table 6 (see in Appendix) presents the constructs that had more than three occurrences in ascending order (frequency). The constructs extracted from the customer experience encompass various aspects, including increased immersion in the consumer experience [17], the motivations felt by the customer during the purchase [65], an increase in hedonic values [18], trust and perception [45], and a range of emotions experienced by the customer during the interaction. These emotions are influenced by experiential stimuli such as enjoyment [92], feelings of ownership and love for the brand [13], as well as functional, effective, and beneficial conditions perceived by the customer throughout the experience [72]. It is worth noting that these characteristics enable customers to make better evaluations of the product, especially when encountering novelty. It can be noted that the most frequent constructs were attitude, interactivity, purchase intention, customer satisfaction, and hedonic value. This is because the research is dedicated to deepening relevant characteristics that the authors believe AR provides towards the customer or towards a personalised environment.

## 3.2. Discussion

The purpose of the systematic review is to gain knowledge about the research conducted in the AR domain and the customer experience when using applications based on AR. Several studies recognize the benefits of using AR in different sectors such as retail, e-commerce, tourism, marketing, education, health, automotive, hospitality, and others, as well as that it presents challenges that remain to be solved. Furthermore, we can observe the interest of the researchers in this topic, which is evidenced by the growing trend of publications in scientific databases in recent years. AR is said to be a growing technology, and this trend is

evident due to the increasing interest in AR research between 2016 and 2021. The highest peak of studies occurred between 2019 and 2020. Coincidentally, during this same period, the COVID-19 pandemic started to engulf the world, prompting further research and implementation of AR to enable some companies in the sales business to continue selling. AR allowed these companies to resolve customers' doubts by providing a new virtual perspective for most of their customers. In this way, these studies contribute valuable knowledge to this area. Most studies are inspired by companies currently utilising AR to gain a competitive advantage in the market and enhance the customer experience. Also, from the results it is concluded that there is no standard definition for RA. On the one hand, the definitions are related to emotional, psychological, cognitive, behavioural, feelings, experience, and satisfaction aspects, among others. On the other hand, the definitions mostly have a focus on technology, novelty and virtual integration. Virtual integration is a characteristic of AR [1]. The authors also believe that AR contributes to increasing the perceived value for consumers during the purchasing process. From the review of the characteristics of AR, it is evident that interactivity is one of the most mentioned in the studies, followed in importance by the improvement of the customer experience and a sense of ownership, pleasure and enjoyment. Our findings shed light on the characteristics and definitions of consumer sentiment as described and explained by the authors in their research. Essentially, consumer sentiment is akin to studying human behaviour, but with a specific end goal in mind. It becomes evident that the authors utilise these concepts to capture the attention of customers and make their products more valuable, thereby generating new emotions or feelings. Regarding the characteristics of customer experience, they have been categorised into different groups, including perception, product evaluation, emotional responses, brand engagement, access to information, stimuli, product testing, and interaction between the company and the customer. Most authors also emphasise the importance of communication and mutual understanding between both parties to evoke specific emotions or perceptions in the customer. The primary objective is often to lead the customer to test the product, which, in turn, instils confidence in them, influencing their decision on whether to invest their money in the product or service. The RQs mentioned in this research are discussed.

*RQ: What constructs are currently being used in customer experience with AR?*

As we can see in Table 6, which presents the first 38 constructs of a total of 97 identified through the review, the main constructs that the authors used to measure, explain, and validate the customer experience were "attitude" followed by "interactivity", "purchase intention", "satisfaction" and "hedonic value". The construct "attitude" is found to be the most relevant in the research and is related to the associated feeling that the consumer feels towards a product. Attitude is an indicator of people's willingness to adopt a certain favourable or unfavourable behaviour. It is said that if the consumer has a favourable attitude towards the product, their intentions to buy and even recommend the product to other future consumers will increase [60]. Another relevant construct was "interactivity" because AR allows interaction between virtual environments and the physical world through a technological device. Interactivity is identified to enhance engagement and improve the flow that the customer has with the brand, achieving emotional reactions and elevating the final consumer experience [33]. It is worth noting that this construct is related to attitude, allowing it to boost the attitude builder, achieving the usefulness and enjoyment of the means offered by this emerging technology [85]. Another construct was "purchase intention" which is the degree of the behaviour of the consumer towards the purchase of a product or service to generate income [79]. Purchase intention is related to customer satisfaction [81] and satisfaction can be said to be a perceived feeling that compares the perceived attitude as the quality of the product with an attitude that the consumer expects at the time of the experience [57]. Some authors also associate this construct with the effort consumers are willing to invest in making purchases after a previous experience [79]. The constructs of "hedonic value" and "utilitarian value" are mentioned as consumer attitude characteristics; however, it was decided to separate them because some authors define these constructs individually in their studies. The results also state that the construct of "information" allows for capturing the confidence the consumer feels at the moment of having the experience [88]. This digital experience must be humanized [93]. It is important to note that these constructs, along with many others, are interconnected and play significant roles in shaping the customer experience during the purchase process.

*RQ1: Does AR provide benefits in terms of hedonic values to customers?*

As shown in Table 6, we can observe that 15% of the selected studies mentioned the "hedonic value" construct that is related to attractive value [47]. The hedonic value is a perception more personal and subjective than utilitarian value [71] where the customer enjoyment of technology [78]. It should be noted that the main constructs are affected by the offers, novelties that the authors use to examine the customer experience. It was also found that these constructs are often affected hedonically and utilitarianly towards the customer. The results of the review have demonstrated the importance of this construct. This result coincides with another experimental study [77], where it was discovered that hedonic value has a positive impact on the intention to use an AR-based application, in addition to increasing inspiration when perceiving emotional gratification. Hsu *et al.* [71] emphasised that the hedonic value influences the intention to continue using an AR-based application, so it is important to increase the enjoyment experience.



That is, if consumers do not see AR as useful, they will not experience a positive hedonic value towards the product. It should also be noted that customer participation at this point is critical to generate hedonic values, which AR being an interactive technology allows to benefit these aspects of participation. However, it is believed that AR also has to be a fun and easy tool for the customer, with the intention of having their full attention without forcing their lack of knowledge about the technology. AR allows a great deal of customisation to the 3D image of the product, which encourages curiosity to try the product and has the potential to generate positive hedonic value towards the customer. The hedonic value of AR contributes to fostering continuous usage intention and AR offers numerous positive aspects that enhance the customer's cognitive experience and foster hedonic value.

*RQ2: Is AR perceived as an interactive and innovative technology by customers?*

As shown in Table 6, we can observe that 20% of the selected studies mentioned the "interactivity" construct and 4% the innovation construct. Interactivity is a relevant aspect because it provides opportunities for companies to interact and cooperate with customers [69]. It is worth noting that the main constructs influencing the customer experience are often influenced by the offers and novelties that authors use to examine this aspect. These constructs are frequently affected both hedonically and utilitarianly from the customer's perspective. AR plays a significant role in generating positive feelings towards a product, as it offers a visual aid that traditional catalogues lack. However, the hedonic value derived from AR is considered to be utilitarian dependent. In other words, customers may experience positive emotions if they perceive AR as useful, and this perception is influenced by the proper functioning of the technology. If consumers do not find AR useful, they may not experience a positive hedonic value towards the product. Customer participation is critical in generating hedonic values through AR, as it is an interactive technology that encourages active engagement. AR should be designed to be fun and user-friendly to capture the customer's full attention without overwhelming them with complex technology. Moreover, hedonic value plays a crucial role in fostering continuous intention to use AR. Through this technology, customers can continually explore different perspectives of the products they are interested in purchasing. In conclusion, AR offers numerous positive aspects, enhancing the customer's cognitive experience and fostering hedonic value, which can significantly impact their purchasing decisions.

*RQ3: Is AR considered a technology capable of influencing customers' purchase intentions?*

As shown in Table 6, we can observe that 19 of the selected studies mentioned the "purchase intention" construct and ranks third on the list of constructs due to its importance. Purchase intention is related to general product evaluation and an emotional reaction reflecting the attitude of consumers towards an object [48]. This construct emerges as a result of the customer's interaction with and perception of the product during their overall experience. In addition, among the characteristics of AR presented in Table 4 are the benefits to the customer by enabling the purchase of an interactive product [24] and allows advertising concerning trust and purchase intention [68]. It captivates the customer's attention while providing enriched information about the product. Customers can comfortably try the product in their surrounding environment, enabling them to make informed and confident purchase decisions. Notably, researchers do not employ numerous definitions of this construct. Some authors gauge purchase intention by the customer's willingness to revisit the shop. This approach stems from the fact that the analysed studies aim to determine whether the characteristics of AR can lead to a positive purchase intention. Finally, AR's ability to provide valuable information about the environment and the product being exhibited significantly influences the customer's purchase intention. The technology enriches the customer experience by fostering positive feelings towards the product, thereby encouraging a greater likelihood of making a purchase.

### 3.3. Limitations

This study is a contribution to knowledge, but it has limitations. First, it is limited by the databases used, so future research should include other databases such as Web of Science to improve research. Second, this research has been oriented towards definitions, the characteristics of AR, the customer experience, and the most used constructs. Future research should analyse the influence of AR on customers' purchase intentions. Third, although the findings of the literature review demonstrate the importance and benefits of its application in the various sectors, there are challenges and limitations of AR that must be identified.

## 4. CONCLUSION

This article presents the results of a systematic review of articles published between 2016 and 2021, focusing on the constructs used to evaluate customer experience. As a result, a total of 88 primary articles were obtained. The research on AR with customer experience was most extensive between 2020 and 2021, primarily driven by the pandemic, which led to increased emphasis on testing and studying this technology during this period. The types of research conducted are predominantly quantitative (90%). The review results reveal that there is no precise definition of AR, and the focus often centres on its technological and virtual integration

aspects. Customer experience is considered a consumer behaviour that occurs during a purchase. Interactivity and customer experience are two of the most relevant features of AR. Interactivity involves enabling communication between consumers and manufacturers, creating a psychological state. A total of 97 constructs related to customer experience characteristics were identified and the most frequently used were “attitude” followed by “interactivity”, “purchase intention”, and “satisfaction” suggesting their suitability for evaluating customer experience. This study will help practitioners, customers, providers, marketers, and policymakers understand the AR characteristics, customer experience characteristics, and the main constructs used to assess customer experience with AR. Practitioners seeking to measure customer experience can consider these identified constructs as the most effective tools for accurately assessing consumers and achieving results that contribute to a correct evaluation. A limitation of this study is that it did not include other databases such as Web of Science and IEEE Xplore. The results obtained from this research can be used to determine the influence of the main constructs on customer experience in further studies. In conclusion, it is hoped that these relevant constructs will serve as a new starting point for accurately measuring customer experience. Further work could involve analysing more constructs oriented towards specific areas, and the evaluation could be closed with a proposal for experimental research to validate our findings.

## APPENDIX

Table 6. Customer experiences constructs

No.	Construct	Related to	Authors
1	Attitude	Development of mental images that lead to a positive attitude towards the product and a greater willingness to buy [60]. Reinforcement of the consumer's intention to continue [66]. System evaluation and consumer behavioural intention [67]. Key value creations that enable the customer to have a positive perceived value of the technology [4]. Mediating consumers' curiosity and attention for something [89].	[4], [6], [13], [17], [24], [27], [32]–[34], [52], [55], [57], [58], [60], [62]–[64], [66], [67], [77], [79], [84], [89], [90], [94]
2	Interactivity	Unique feature of AR applications [33]. Responsiveness and communication between consumers and manufacturers [60]. Consumers' perception of how they are influenced by the components of technology [2]. It elicits affective responses of immersion, enjoyment, and liking for the product [14]. The ability of technology to allow users to interact, manipulate, and engage with content more easily [3]. It facilitates the processing of information and enhances customers' knowledge of the product and service demonstrated [66].	[1]–[3], [6], [14], [33], [35], [56], [60], [61], [65], [66], [70], [71], [85], [95]–[97]
3	Purchase intention	Consumers' willingness to buy a future product [95]. General product evaluation and an emotional reaction reflecting the attitude of consumers towards an object [48].	[10], [12]–[14], [26], [43], [53], [55], [57], [61], [63], [79], [81], [83], [89]–[91], [98], [99]
4	Satisfaction	Emotional outcome of the evaluation of services [91]. Evaluation of output versus input [31]. Resulting from the creative involvement of the customer [80]. Post-consumption experience that compares their perceived attitude with their expected attitude [57]. Intention to recommend based on behavioural response [15]. Affective response [79]. Influence on the entertainment, educational, escapist, aesthetic experience of the user [81].	[2], [3], [6], [12], [15], [26], [31], [57], [73], [79]–[81], [87], [91], [97]
5	Hedonic value	Perception more personal and subjective than utilitarian value [71]. Customer enjoyment of technology [78]. Attractive value [47]. Positive relationship with inspiration [9].	[1], [9], [17], [25], [47], [66], [70], [71], [76]–[78], [84], [85], [87], [99]
6	Information	Presentation of an online product [43]. Attitudes without taking into account experiential hedonic responses [14]. Facilitator of consumer understanding of the product [66]. Subjective evaluation of online product presentation [43].	[14], [25], [32], [43], [51], [58], [66], [71], [73], [88], [95], [98]
7	Enjoy	Innovative visualisation experience provided by AR [3]. Predicting inherent user performance towards a new system or activity [27].	[3], [6], [14], [24], [26], [27], [32], [43], [53], [55], [57], [58]
8	Quality	An important precursor for the development of inspiration [9]. Provokes immersive cognitive and affective responses [14]. Refers to the ability to generate useful and trustworthy content [31]. Sense of realism of experience [67]. Involvement of the experience co-creation process and visualisation of perceived value [4].	[4], [9], [14], [15], [31], [67], [73], [77], [85], [86], [100]
9	User experience	Personal experience gained from an individual's activities of exploration and experimentation in his or her external world [94]. It involves a set of sensory, behavioural, social, and intellectual experiences using AR [72]. Customers' experiential value of products [79].	[1], [9], [49], [54], [63], [68], [72], [81], [82], [94], [99]
10	Facility	Perception of using an effortless function or system [3]. Synthesis of consumer perceptions of the ease of use of technology [66]. Generates a mental preview of the displayed environment compared to digital content [10].	[3], [9], [10], [26], [27], [34], [58], [66], [67], [94], [99]
11	Intention to use	Satisfaction score of users of AR applications they purchase [85].	[3], [14], [32], [34], [71], [73], [75], [79], [85], [94], [100]
12	Utility value	It derives from object-oriented service and the sense of “achievement” during the shopping journey [71]. Characteristics of functional aspects to solve problems [25]. Derived from instrumental-driven, goal-oriented pleasure [70].	[18], [27], [55], [66], [70], [71], [75], [77], [78], [85], [99]

Table 6. Customer experiences constructs (*continue*)

No.	Construct	Related to	Authors
13	Behavioural intention	Consumers' willingness to buy a future product [95]. User satisfaction outcome conscious of whether or not something is achieved [97].	[12], [55], [56], [58], [59], [66], [67], [83], [97], [99]
14	Utility	Perception that using a technological function or system is effortless [3]. Extent to which people believe that AR increases product search or reduces effort time [14]. Users who consider the use of technology to be beneficial to their job performance [94].	[2], [3], [14], [25], [32]–[35], [58], [94], [98]
15	Presence	Persuasive factors influencing the value of the consumer experience [101]. Underlying mechanism through which the display of actual content combined with a device can affect potential customers [10]. Part of the user's physical world [41]. Psychological state that users feel as if they are in a new world [25].	[10], [17], [25], [41], [47], [53], [79], [101]
16	Control	Comfort of necessary decisions translating behavioural intentions [59].	[7], [31], [59], [61], [63], [78], [82], [102]
17	New at	Ability to offer new experiences never encountered before [85]. Unique, personalised, and novel information that is presented to individuals every time they use AR technology [2]. New, unique, personalised, and novel content that is experienced through the AR display [3].	[2], [3], [27], [35], [49], [51], [85], [88], [103]
18	Aesthetics	Ability of the application to present more realistic products in an AR environment [15]. Feeling of harmony and entertainment when using the AR application [75]. Influence on users' online flow experience [88].	[6], [12], [15], [65], [67], [75], [81], [88], [101]
19	Immersion	Imagining the feeding process including visualising the 3D effects of the technology [96]. Perception of consumers interacting with a product and enjoying the technology [14]. It is characterised in two ways, sensory immersion based on media characteristics and user experience centred [17]. Psychological concept that is often discussed but is distinguished from flow or presence [46].	[6], [7], [14], [17], [35], [46], [56], [96], [97]
20	Trust	Clarity with which consumers understand and believe that these preferences are correct [14]. Belief or positive attitude to something [62]. Feeling of interaction and whether a product is safe or not [49].	[14], [33], [45], [49], [62], [97], [98], [103]
21	Cognition	Evaluating the information provided and predicting the next steps in a given situation [61].	[13], [50], [61], [64], [72], [79], [86], [104]
22	Attractive	Perceived superiority of an option over other competing options [47]. Experience with which virtual elements are exhibited and enable states of presence in the environment [10]. User's overall impression of the object being evaluated [49].	[10], [47], [49], [53], [97], [99], [103]
23	Flow	Deep immersive state [2]. Stimulus processing that influences cognitive processes [13]. Temporarily unconscious experience in which viewers engage with AR marketing with full control, enjoyment, and concentration [88]. Essential driver for customer engagement [33].	[2], [13], [33], [83], [88], [90], [104]
24	Perception	Increased purchase intent for a product achieved by immersion in the environment and increased trustworthiness [101].	[26], [32], [54], [67], [79], [101]
25	Liveliness	Positive evaluation of increased consumer immersion generated by innovative media [35]. It increases the perception of information quality and also cognitive processing [2].	[2], [3], [27], [35], [53], [61]
26	Entertainment	Influences perceived value among consumers [75]. Absorption experience [81].	[12], [51], [65], [75], [81], [98]
27	Personalisation	Exclusivity, quality, and prestigious image of the products [86]. Customised AR application tailored to customers according to their unique preferences [71]. Underlying process that generated positive effects on brand responses [41].	[41], [63], [71], [85], [86]
28	Commitment	Cognitive aspect, customer interactivity with brands [69].	[33], [69], [80], [85]
29	Innovation	It provides opportunities for companies to interact and cooperate with customers [69].	[45], [62], [69], [105]
30	Escapism	Avoiding aspects of daily life that are boring, unpleasant, or routine [12].	[12], [53], [75], [81]
31	Inspiration	The customer's psychological inspiration, driven by the concatenated effects of AR attributes, along with its utilitarian and hedonic benefits, significantly influences the intention to continue using the AR shopping application and the willingness to pay extra for it [85].	[9], [33], [77]
32	Inlay	Visual integration of virtual content into a person's real-world environment [78].	[13], [46], [78]
33	Availability	It has a positive and direct impact on consumer loyalty intentions in AR beauty applications [76].	[43], [76], [94]
34	Efficiency	Essential building block in any shopping platform [76].	[49], [76], [103]
35	Comfort	Assessment of the degree of mental intangibility [59].	[46], [55], [59]
36	Compatibility	Consistency with user needs [106].	[7], [84], [106]
37	Benefits	Measurement that allows in various ways to acquire rich information about the product and to enrich consumer knowledge in the decision-making process [79].	[9], [73], [79]
38	Taste	Familiarity and more positive attitudes towards the product [14].	[14], [72], [102]

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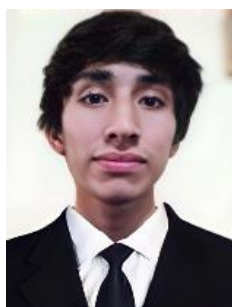
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