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Drivers of VR Adoption by Generation Z: Education, Entertainment, and Perceived Marketing Impact

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Abstract: Virtual reality (VR) can influence people's lives and business development. It can bring immersive experiences for people and can strengthen the relationships between customers and companies. In this paper, Generation Z (Gen Z) members' interest in VR is analyzed in various domains, like education, entertainment, and marketing. This study considers the Technology Acceptance Model (TAM) theoretical framework and explores the factors influencing Gen Z's perceptions of VR potential. The approach is based on hypotheses and a survey-based investigation, followed by logistic regression modeling. The results show that VR attracts Gen Z members to educational and entertainment activities. Also, they believe that VR is important for marketing activities. The results show the importance of investments in VR, in all three domains, and the importance of adapting strategies to leverage VR's potential effectively.

Keywords: Generation Z; consumer behavior; education; entertainment

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1. Introduction

Virtual reality (VR), a cutting-edge technology tool, has emerged as a significant and appealing phenomenon. It is a fusion of advanced technological innovations, including 3D near-eye displays, intelligent display technology, and intelligent interaction technology. VR offers users an immersive and dynamic virtual world experience (Habes et al., 2023). This immersive 3D simulated environment allows users to immerse themselves in sensory experiences akin to spatial presence while simulating real-world scenarios and granting a flow experience (Nguyen et al., 2023).

VR should be understood as a catch-all word encompassing a variety of computer-generated, three-dimensional visualization technologies with a few traits (Söderman, 2005). First, it is an environment or item created by a computer. Second, it is immersion or the feeling of being in the virtual world; non-immersion VR technology includes desktop computer displays of objects and places. Additional features include real-time navigation within the virtual world and manipulating the object's perspective based on the viewer's movements and position.

Immersion VR provides a computer-mediated technique of human-to-human communication that uses visuals and additional sensory stimulation (Barricelli et al., 2016). VR enables users to engage with a realistic virtual area through their actions in reality and the information they broadcast to the virtual world (Trappey et al., 2021). Thus, users engage with a different reality and fully submerge themselves in it (Stecuła, 2022). Shortly, users

may be able to experience VR firsthand because most people own smartphones, making it simple to acquire and use VR apps and content (Song et al., 2021).

Its potential to enhance people's lives and drive organizational growth has been widely acknowledged (Yuce et al., 2020; Yung et al., 2021). As VR becomes increasingly prevalent in society and businesses, understanding its applications is becoming more urgent and crucial (Steffen et al., 2019). However, whether VR genuinely revolutionizes the economy or is merely a hyped trend driven by inflated expectations remains debatable (Preece et al., 2022). A deeper understanding of the market and a more realistic expectation of external developments are made possible by increasing the use of artificial intelligence (AI) technologies in marketing or customer relations processes, for instance. This ensures that company strategies and policies are more accurate (Ștefan et al., 2024). AI can be used by businesses to boost output, enhance customer satisfaction, innovate, plan marketing campaigns and plans, expedite decision-making, and automate jobs. Consequently, they might obtain a competitive edge and set themselves apart from their rivals (İşgüzar et al., 2024).

In recent years, VR has been more widely available due to falling costs and an increase in the availability of accessible content (Griffin & Muldoon, 2022). As VR technology advances, it provides opportunities to transform how people study, work, and engage with the outside world (Steffen et al., 2019). By offering accessibility, ease, and immersive experiences in a variety of spheres, including public speaking, virtual entertainment, mental health, social interactions, education, and travel, VR will revolutionize the human experience (Pratama & Putra, 2024).

Generation Z (Gen Z), Post-Millennials or the iGeneration, is considered to be the technology-age generation (Ozdemir-Guzel & Bas, 2021). Their members are well informed and engage constantly with digital content (Chaudhari et al., 2023). They differ from the members of other generations as they use smart devices in their pursuit of excitement, authenticity, or unique experiences. Since they grew up with technology in their hands (Wenzel & Copeland, 2020), they are now good visual learners, which is highly relevant to their link to VR technology, as they are digital natives of it (Strong et al., 2023). This generation's interest in such technology is the highest (Kapusy & Logo, 2017). It can go to such an extent that studies have shown that even though VR makes their experience fun and interactive (Cieslowski & Haas, 2022), it can, especially in entertainment, stir up addiction (Saneinia et al., 2022). The levels of involvement in VR can vary within this generation, and differences can be seen in the purpose for which it is used: girls' VR activities are more linked to interpersonal interaction and, implicitly, communication, and boys tend to choose it more for its gaming capabilities (Puchkova et al., 2017).

This paper is focused on analyzing the interest of Gen Z members in using VR for education, entertainment, and marketing. This paper is structured as follows: The next section contains the literature review regarding the use of VR. Section Three is the methodology description. In Section Four, the data are analyzed. In Section Five, the results are discussed. The last section concludes the paper.

VR can be useful in education, entertainment, and marketing. Gen Z is very attracted to technology, and this is why it is important to analyze the perceived value among Gen Zers. This analysis is significant, mainly because there is limited research on VR adoption in Romania. The results provide insights into the adoption factors in this regional context.

Gen Z can have a relevant impact on future developments in the technological area. The focus on those three domains (education, entertainment, and marketing) is made to provide a perspective on the VR interest of this generation. Logistic regression is used in this research to check the relationships between various variables and VR use.

A contribution to the literature is brought by the discussions related to technology adoption in the context of behavioral economics. Thus, the perceived utility and immersive experiences' impact on VR adoption among Gen Z members is analyzed.

2. Literature Review and Hypotheses Development

2.1. VR and Education

The literature examines how VR may be tailored to various knowledge categories, and its real-world educational uses are evaluated. Applying VR in education enables immersive learning experiences for students while supporting teachers in adopting digital-age teaching methods (Jiang et al., 2018). Also, how VR can affect students' motivation, interest, and involvement in the learning process is examined, showing that the students are interested in using VR and exploring various research areas (Santos Garduno et al., 2021). VR can improve student engagement by simulating real-world work situations through realistic and immersive experiences (Rafiq et al., 2022).

Education has recently seen immense transformations, the traditional model shifting toward a more personalized and flexible approach (Radu et al., 2024). This is highly based on using AI and other modern technological applications. One useful tool that raises student engagement and improves learning results is VR (Farouk et al., 2024). Studies suggest that abilities learned in immersive VR environments may be successfully used in real-world contexts (Levac et al., 2017).

VR technology is one possible way to implement the latest teaching methods and approaches needed to meet the new problems in education (Paszkiewicz et al., 2021). Because of VR's immersive qualities, users can interact and engage with digital objects in real-time. This approach has an impact on the sensation of presence in the artificial world (Gharaybeh et al., 2019). VR can enhance learning effectiveness and engagement (Portuguez-Castro & Santos Garduño, 2024). VR provides students with an immersive and interactive learning environment, enabling them to understand complex concepts and ideas more quickly and effectively (Marougkas et al., 2023). Because VR technologies can replicate real-world situations and give students hands-on experiences, they can improve the accessibility of abstract, complicated topics (Chalkiadakis et al., 2024). VR can expand the learning process with a more realistic and intuitive environment (Tarng et al., 2024). VR facilitates a more participatory learning and more inclusive and transparent education environments (Chalkiadakis et al., 2024).

Students can investigate and interact differently with objects in VR than in the classroom. VR has the potential to revolutionize fluid power teaching (Azzam et al., 2024). Through interactive exploration and active engagement, VR offers a first-rate human–computer interface to support the development of comprehensive concepts and practical knowledge (Dunleavy et al., 2008).

VR is used in various educational contexts. There are clear pedagogical advantages for science, technology, engineering, and mathematics (STEM) education (Zhang et al., 2024). Construction professionals can use VR to navigate through building sequences. This can proactively mitigate potential challenges during the actual construction phase. Engineering students can analyze complex structures. Architecture students can iterate on designs (Farouk et al., 2024).

VR can provide students with a tailored learning experience (Wee et al., 2022). This has a good impact on their understanding of the course material (Campos et al., 2022). Important factors like incorporating VR into the curriculum and determining which surroundings provide the best results for students must be taken into account while choosing the finest applications (Portuguez-Castro & Santos Garduño, 2024).

One of the main components of experiential learning is the ability of learners to practice skills, make mistakes, and iterate, which is made possible by immersive VR simulations (Goodwin, 2008). By not using VR in the classroom, we are missing out on a potent technology that has the potential to completely transform education and make it more meaningful and pleasurable for all students (Elmqaddem, 2019).

To effectively handle the problem of providing individualized teaching to meet the unique needs of each student and to increase their engagement and interest, these contemporary systems can be built in certain ways. In addition, they can offer certain teaching methods that, in contrast to more conventional ones, might be more palatable to a variety of students (Kazimzade et al., 2019). The usefulness of VR in raising engagement and learning outcomes is demonstrated by the way it improves student motivation in terms of attention, relevance, satisfaction, and confidence (Portuguez-Castro & Santos Garduño, 2024).

In a virtual setting, students can collaborate with their classmates to work on projects and learn from one another (Al-Ansi et al., 2023). The simulation of real-world industry operations enables collaborative experiences that empower experts from various disciplines to communicate and cooperatively address difficulties within a shared virtual area (Rodolico & Hirsu, 2023). VR can also facilitate better teacher–student communication.

VR environments are essential for education because they give students the critical thinking and practical skills they need to succeed in their future employment (Azzam et al., 2024). Students are empowered to derive their ideas from their virtual experiences thanks to VR's promotion of independent thought (Wilson & Soranzo, 2015).

The use of VR in education has the potential to spur creativity and result in the creation of new approaches. Immersion VR can help students better comprehend other cultures by exposing them to a variety of viewpoints (Alfadil, 2024). VR holds promise for strengthening students' socio-emotional, cognitive/meta-cognitive, and pedagogical learning growth (Cevikbas et al., 2023). Personalized learning experiences are possible through the customization of immersive VR integration to meet the needs of specific learners (Alfadil, 2024).

However, integrating VR technology into education is difficult, since educational institutions are very concerned about the expense of implementation (Farouk et al., 2024). The disadvantages of VR include high costs, technical challenges, and the need for improved assessment tools (Muzata et al., 2024). VR used in education can bring the learner physical discomfort when wearing the headset and technical difficulties (Zhang et al., 2024).

As a result of previous statements, we developed the subsequent hypothesis: H1: Gen Z is more likely to use VR for educational activities compared to not using it. This aligns with the binary nature of our dependent variable in the econometric model. Also, it is focused on whether respondents use VR for educational purposes (measured as yes/no), representing the independent variable VR_education.

2.2. VR and Entertainment

VR technology is extensively used and broadly accepted in the entertainment and gaming industries (Chirico et al., 2015; Abdelmaged, 2021). It is constantly evolving, and new applications are in constant development, in which immersive experiences can be integrated (Kodama et al., 2017), filling the users' visual fields (Oriti et al., 2021). The majority of people have experienced VR, albeit infrequently, and entertainment was the most popular use case (Hornsey & Hibbard, 2024). Throughout time, VR entertainment applications have experienced stages of germination, doldrums (Jia & Chen, 2017), and turbulence and are now undergoing rapid explosion and expansion. The use of VR has the potential to enhance the appeal and satisfaction of industrial heritage tourism. It can offer an immersive visitation experience and draw in a larger audience. Using touch screens,

interactive gadgets, and multimedia, digital interactive exhibitions enable visitors to take part in the investigation of industrial legacy (Fang et al., 2024).

Even though VR encompasses both immersive and non-immersive experiences (Rocha et al., 2020), it is considered a highly immersive medium for entertainment (Hock et al., 2017). Through an immersive, individualized approach that connects the past and present, the user can learn about the location and its history through the VR application, tour the city's historical sites and archeological monuments, expand their knowledge, and enjoy entertainment (Kargas et al., 2022).

The application of VR in entertainment highlights multiple benefits, such as using or analyzing data in a new way (Kim, 2016), improving sensorial experiences, and having no mobility restrictions (Hock et al., 2017), going further than the basic mimicry of a physical experience (Burt & Louw, 2019). Its ease of use or perceived enjoyment (Lee et al., 2019) creates new and fun realities that can only be virtually possible (Schlacht et al., 2017). Characters and storytellers within the VR environment can improve the VR experience. They could be performers in real life or virtual humans (Okanovic et al., 2022).

Entertainment is a psychological effect resulting from VR interactions that users experience, and such interactions in this type of world influence user enjoyment (Bermejo-Berros & Gil Martínez, 2021). Moreover, the amount of interactive behavior is not as relevant as the quality of it when analyzing the perception of entertainment in the VR space. In certain cases, the experience is made more intense by using the potential of three-dimensional VR to provide the user with the chance to explore and learn about each city's history and riches while touring alone (Kargas et al., 2022). VR digital heritage applications are used online or in museums, and user engagement must be straightforward and intuitive (Okanovic et al., 2022).

VR plays a vital role in entertainment, seeing that it is an artistic form that promotes interactivity. It can market different media outputs and is a supplementary experience linked to a different form of media (Powell et al., 2017). Since immersive VR is a successful medium for creating social experiences, it may be a helpful tool for teenagers' socio-emotional learning. There are a few things to keep in mind, though, such as motion sickness, technology weariness, and cost-effectiveness. Second, initiatives should be taken to encourage students to embrace technology by using the immersive VR environment to provide social experiences (Li et al., 2024).

Starting from the literature, the following hypothesis was formulated: H2: Gen Z's likelihood of using VR increases with higher self-reported engagement in entertainment activities. This directly connects the respondents' opinions on the usage of VR in entertainment activities (measured on a Likert scale, variable VR_entertainment) to the binary dependent variable in the econometric model.

2.3. VR, Marketing and Consumer Behavior

The rapid change and broad adoption of effective AI offer unique opportunities including optimization, progress, increased productivity, increased sales and marketing, growth, lower expenses, and increased profitability (Soni, 2023). The literature analyzed how internal and external organizational agility may be used to improve customer service performance in the context of marketing operations by utilizing AI technology (Wang et al., 2022). Factors like efficiency, scalability, and the capacity to create customized content drive the use of GenAI in digital marketing (Soni, 2023). Because GenAI can generate customized outputs, it can be very effective in fields like customer relationship management and digital marketing (İşgüzar et al., 2024).

VR is rapidly shifting away from its conventional application in entertainment. Businesses are beginning to incorporate it into their operations (Zhao et al., 2019). VR technolo-

gies have been utilized for over a dozen years to tackle a variety of real-world challenges and business cases, despite the recent surge in interest in them (Zhao et al., 2019).

Today, VR is a sophisticated, feature-rich technology becoming increasingly popular as a valuable marketing tool (Branca et al., 2023). VR marketing has emerged as a crucial tool for businesses looking to improve their competitiveness, and it may be the most significant marketing breakthrough of the twenty-first century (Zeng et al., 2023). Both makers and researchers must comprehend how consumers feel about VR technology and stay abreast of those sentiments as new versions of the devices are introduced. Businesses can decide on product development, marketing tactics, and market positioning with the knowledge of consumer perceptions, preferences, and adoption hurdles (Hornsey & Hibbard, 2024).

VR has been studied in marketing from various angles, including how consumers perceive products and offers, how it affects business-to-business (B2B) buyer perceptions, how brands are evaluated, and how their vividness effect may affect how consumers perceive them (Russo et al., 2022). VR generates a virtual entity to impact the digital marketing strategy and enables digital content visualization on the internet platform (Tang et al., 2023). Virtual vehicle inspections and automated claims management are two examples of process changes that have required companies to adjust their skills and competencies. New data analysis abilities and VR/augmented reality (AR) capabilities have also been embraced (Abdallah-Ou-Moussa et al., 2024).

Experts and specialists underline that VR has a high chance of becoming the subsequent extensive technology development. Economic operators will use VR to influence consumer behavior (Yung et al., 2021). The consumer industry is seeing a boom in interactive VR systems due to advancements in modern computing (Dehghani et al., 2022). VR is a promising technology that can improve the overall customer experience because it significantly affects users' sensory aspects (Farah et al., 2019). These immersive devices produce a virtual setting that makes it easier to perceive and comprehend financial ideas and products, which improves decision-making and increases consumer happiness (Soni et al., 2022).

Immersion experiences are the e-commerce industry's next frontier thanks to developments in VR. A deeper, more educational shopping experience is provided by the creation of interfaces that let customers interact with things virtually. VR technology allows robust client connection in both virtual and real worlds. It also offers a degree of interaction that was previously unattainable through conventional digital channels (Goyal et al., 2023).

The theory most frequently used in research to explain the behavioral effects of virtual experiences is the Technology Acceptance Model (TAM). According to the TAM, users' attitudes that precede their intention to use and subsequent actual usage are influenced mainly by their perceptions of perceived usefulness and simplicity (Godovykh et al., 2022).

VR headset use could significantly impact prospective customers as they reported a higher degree of destination image construction, including a cognitive, affective, and overall appraisal of the advertised area (Adachi et al., 2022). Furthermore, embodied VR technology improved behavioral and psychological involvement (Flavián et al., 2020). When consumers interact with a product in a highly engaging VR setting, they also give considerable weight to its esthetic features (Kang et al., 2020).

Virtual experiences have been shown to influence attitudes, general behavioral intentions, use intentions, purchase intentions, visit intentions, revisit intentions, intentions to suggest, and sustained use, among other outcomes related to this model (Godovykh et al., 2022). The primary reasons for the visits to the virtual environments are for socializing and pleasure (Vrechopoulos et al., 2009).

Immersive virtual environments can be created and customized. Vendors can create themed areas that improve the shopping experience. This improves user engagement and offers a distinctive purchasing experience (Castro-Schez et al., 2024).

Additionally, personalization is improved by integrating e-commerce to make the buying and administration of insurance policies easier and by using VR to interactively simulate and assess risks (Abdallah-Ou-Moussa et al., 2024). VR-themed spaces enable vendors to design and personalize VR-themed areas to showcase their goods in a more captivating and relevant manner. This feature gives the ability to design surroundings that are tailored to the esthetics and background of the selling goods (Castro-Schez et al., 2024).

Interest in VR positively influences travelers' behavior and intention to travel (virtual vs. actual) indirectly through the function of several mediators, including appraisal, attitude, and desire. Individuals experience internal psychological shifts in their intentions, attitudes, and ability to take actual action (Geng et al., 2022). The paradigm now includes several hierarchical components: perception, consciousness, assessment, knowledge, cognition, understanding, etc.

Since VR is a relatively new technology, audiences find it interesting, and it helps businesses become more competitive, particularly if they are actively engaging with the younger generation (Zhao et al., 2019). Several benefits increase this generation's level of interest. Gen Z perceives VR as appealing to their senses (Choirisa, 2022).

VR technologies' introduction and widespread adoption in the business sector are hampered by a few problems. The primary barrier is the exorbitant expense of technologies and solutions, which has no discernible relationship to economic efficiency. The introduction of VR technologies is complicated and has technological constraints in addition to being expensive (Zhao et al., 2019). VR use raised concerns about the use and privacy of user data, the possibility of nausea, discomfort, and eye strain, and the dangers that come with being cut off from the real world (Hornsey & Hibbard, 2024).

As a consequence of the previous statements, we formulated the following hypotheses:

H3: Gen Z is more likely to believe that VR will change companies' marketing approaches than not believe it. This emphasizes the binary nature of the independent variable (measured as yes/no) regarding Gen Z's belief in VR's impact on marketing (VR will change or not change the way companies approach marketing, representing the variable VR_MKCOMP). Thus, this hypothesis directly links the likelihood of having this belief to the likelihood of using VR (the binary dependent variable in the econometric model).

H4: Gen Z is more likely to perceive that VR content in marketing activities influences consumer behavior if they use VR compared to not using it. This focuses on the relationship between the degree to which Gen Z perceives VR content in marketing activities to influence consumer behavior (measured on a Likert scale and representing the variable CB_MK_VR) and their likelihood of using VR (the binary dependent variable in the model).

3. Materials and Methods

3.1. Econometric Model

Researchers commonly employ logistic regression to build models that divide observations into two or more categories or groups. Several applications of these models are in all fields, including business, economics, social sciences, biology, and medical sciences (Hadjicostas, 2006). In general, logistic regression is a valuable tool for evaluating theories on the connections between one or more continuous or categorical predictor variables and a categorical result variable (Peng et al., 2002). Essentially, the logistic model uses X to predict the logit of Y. Binary logistic regression represents a regression analysis using dummy variables as the dependent variable. When the independent variables are continuous, categorical, or both, and the response variable is dichotomous, this version of standard

linear regression is employed (Midi et al., 2010). The multiple binary logistic regression model that we use is as follows:

$$P(Y = 1|x_1, \ldots, x_n) = \frac{e^{\beta_0+\beta_1 x_1+\cdots\beta_1 x_n}}{1 + e^{\beta_0+\beta_1 x_1+\beta_1 x_n}} = \frac{e^{X\beta}}{1 + e^{X\beta}} = \frac{1}{1 + e^{(-X\beta)}} \quad (1)$$

In the equation above, P represents the event's probability, Y is a binary variable that takes the values 0 or 1 (and 1 is the one that is being predicted), $\beta_1, \ldots, \beta_n$ are unknown parameters, and $x_1, \ldots, x_n$ are the independent variables. The linear predictor function is denoted by $X\beta$. The widely used estimation method for determining the parameter β is the maximum likelihood approach (Ertan & Akay, 2022). The following are the success odds for binary logistic regression:

$$\frac{p}{1-p} = e^{\beta_0+\beta_1 x_1+\cdots\beta_1 x_n} \quad (2)$$

The equation above expresses the probability of falling into the present interest category as an equation. As previously mentioned, odds are ratios of the probability (p) of Y occurring to the probabilities ($1 - p$) of Y not occurring, and the logit is the natural logarithm (ln) of the odds of Y. The odds of an event are, by definition, ($\frac{p}{1-p}$). Secondly, a complex logistic regression for Y was constructed:

$$logit(Y) = ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \cdots \beta_1 x_n \quad (3)$$

This model describes the likelihood of an event occurring as a function of X factors. The relationship between the dependent variable and its predictors can be positive or negative, as the coefficient β indicates. Odds ratios above one suggest that when the independent variable rises, the odds of the dependent variable increase as well. Conversely, an odds ratio of less than one indicates that as the independent variable increases, the odds of the dependent variable fall (Field, 2013).

The variables' multicollinearity was evaluated. Multicollinearity influences computations about specific predictors. It does not affect the model's overall predictive capacity or reliability. The presence of multicollinearity inflates the variances of the parameter estimations (Midi et al., 2010).

The variance inflation factor (VIF), the reciprocal of tolerance, is the primary tool used in mathematics to identify multicollinearity (Midi et al., 2010; Field, 2013). The variance inflation factor is estimated as follows:

$$VIF = \frac{1}{Tolerance} = \frac{1}{1 - R^2} \quad (4)$$

In the equation above, R^2 denotes the coefficient of determination for the explanatory variable's regression on all other independent variables. A tolerance value around 0 implies that multicollinearity can be dangerous, while a tolerance close to 1 shows that multicollinearity is minimal (Midi et al., 2010). A VIF between 5 and 10 indicates a high correlation between the predictors. Several tests were employed to examine the model fit.

Regression analysis model coefficients should be evaluated using two crucial procedures to test the model fit: the Omnibus Test of Model Coefficients and the Hosmer and Lemeshow test (Field, 2005; Hosmer et al., 2013). These tests are essential to demonstrate if the independent factors can explain the dependent variables (Kilic & Gülgen, 2020). The Omnibus Test of Model Coefficients was used to ascertain whether there was a noteworthy enhancement compared to the null model. The test determines whether the explained variance of a collection of data is often significantly more significant than their unexplained

variance (Lomax & Hahs-Vaughn, 2012). When the significant value in the omnibus test is less than 0.05, the null hypothesis is rejected.

One often-used goodness-of-fit test for assessing logistic models is the Hosmer–Lemeshow test (Yu et al., 2017). The Hosmer and Lemeshow test also evaluates the discrepancy between the observed and predicted models (Field, 2013). The test assesses how well the observed and predicted occurrences in the model population's subgroups match each other. In this test, the significance threshold value is typically 0.05. If the test value exceeds the threshold, it is confirmed that the logistic regression model is suitably fitted.

The area under the receiver operating characteristic curve (AUC), or ROC curve, was measured as part of the model validation process. Specificity is the percentage of correctly classified data for the subset of data with Y = 0. At the same time, sensitivity is the percentage of correctly classified data for the subset of data with Y = 1 (Hadjicostas, 2006). Thus, AUC = 1.0 represents the perfect ROC curve.

In the analysis, data related to the opinions of the same individual were at the base of the independent and dependent variables. This impacts how the results can apply in other contexts. It is important for future research to address these aspects and to discuss the endogeneity problem.

3.2. VR and Explanatory Variables

Binary logistic regression was used in the statistical analysis, carried out with IBM SPSS Statistics version 29.0. After reviewing the literature, four explanatory variables were selected to predict VR. The VR predictors are described in Table 1. The response variable (VR) is binary, corresponding to the question from the questionnaire: Have you used virtual reality tools?

Table 1. VR and explanatory variables.

Independent Variables' Definitions	Coding	Questions from the Questionnaire
Respondents' usage of VR in educational activities	VR_education	Have you used virtual reality in educational activities? (Yes/No)
Respondents' usage of VR in entertainment activities	VR_entertainment	How often do you use virtual reality for entertainment purposes? (5-point Likert scale from very little to very much)
VR will change the way companies approach marketing	VR_MKCOMP	Do you think that virtual reality will change the way companies approach marketing? (Yes/No)
VR content in marketing activities changes consumer behavior	CB_MK_VR	Have you noticed a change in your purchase behavior following exposure to virtual reality content in marketing activities? (5-point Likert scale from a very small extent to a very large extent)

The choice of logistic regression was guided by the binary nature of the dependent variable, which is labeled as '0' and '1'. Logistic regression is well suited for binary outcomes, as it models the probability of an event's occurrence and ensures interpretability in terms of odds ratios. This approach aligns with the study's objective.

3.3. Questionnaire and Sample

We applied the questionnaire between October 2023 and February 2024 using Google Forms. The approach included dichotomous, closed-ended with a Likert scale and closed-ended questions with multiple responses. The lack of open-ended questions influenced the possibility of obtaining personal perspectives. The sample size is 447 respondents.

The questionnaire has mandatory questions, meaning that respondents had to answer each one before going to the next one. This approach was used to ensure reliability. The questionnaire was administered to young Romanian people from Gen Z who were older than eighteen. The gender distribution was 49.7% male and 50.3% female (Table 2). Concerning income, 53.7% had RON 1000 (approx. EUR 200) or less, 10.1% had more than RON 4000 (approx. EUR 800), and 36.2% had between RON 1001 and 4000. Education-wise, 50.1% had a bachelor's or a master's degree, while 49.9% had completed high school, post-secondary, or professional studies. As for occupation, 16.8% were employees, 79.8% were students, and 3.4% were entrepreneurs. Convenience sampling was used. This allowed us to choose respondents from a convenient subset of the population (Baxter et al., 2015; Edgar & Manz, 2017). This approach is a less rigorous form of non-probabilistic sampling. One positive aspect is emphasized by the fact that it allows us to capture various viewpoints, which can serve as valuable input for future research (Albert et al., 2009).

Table 2. Summary of the sample.

Measure	Item	*N* = 447	Frequency %
Gender	Male	222	49.7
	Female	225	50.3%
Education	High school/post-secondary studies/professional studies	223	49.9%
	Bachelor's degree/master's degree	224	50.1%
Average monthly income	RON 1000 or less	240	53.7%
	RON 1001–4000	162	36.2%
	More than RON 4000	45	10.1%
Occupation	Student	357	79.8%
	Employee	75	16.8%
	Entrepreneur	15	3.4%

The use of convenience sampling can lead to the over- or under-representation of certain subgroups. That is why the generalizability of the findings is limited. We have a balanced sample distribution in terms of gender and educational attainment. Although students are an accessible subset of the population, they might not represent the entire Gen Z. This study recognized these potential biases and suggests that future research should use more representative sampling methods.

Also, a set of close-ended questions was applied to the respondents further to depict Gen Z's opinions concerning VR tools, focused on the following:

- VR changes that companies need to address in their marketing activities.
- Types of products or services that would benefit the most from the use of VR in marketing strategies.
- Main advantages of using VR in marketing.
- Changes in consumer behavior due to exposure to VR content in marketing activities.
- Methods of influencing the purchase decision that can be adopted in marketing campaigns based on VR.

A bias might result from the use of closed-ended questions. This type of question might limit the ability to discuss various opinions beyond predefined options and to the simplification of complex behavior. One approach in this respect was to design the questions in a way that did not guide the respondents toward specific answers.

4. Results

4.1. Model Fit

A ROC curve is a graphical figure that shows how well the binary classifier model performs at different threshold levels (Figure 1). The variables VR_education, VR_entertainment, VR_MKCOMP, and CB_MK_VR jointly projected the VR with an AUC of 0.704. The discrimination is deemed acceptable if $0.7 \leq \text{ROC} < 0.8$ (Hosmer et al., 2013). As a result, this regression model provides moderate discrimination capacity, with room for improvement in sensitivity and specificity.

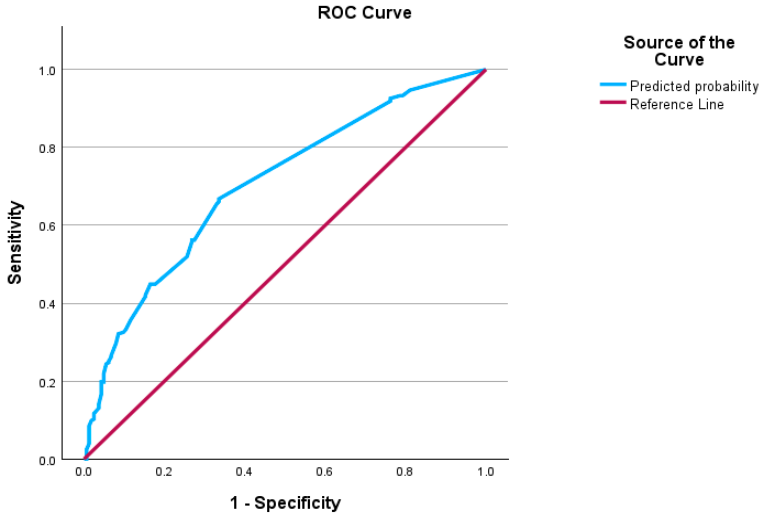

Figure 1. ROC curve; the model with VR as the dependent variable.

A linear model was initially performed on the answers as a function of the predictors to ensure there were no multicollinearity issues. Multicollinearity decreases with decreasing VIF. The statistics indicate no collinearity between the predictors because their VIF values range from 1.015 to 1.288 (Table 3). The test results show that multicollinearity does not exist in the logistic regression model.

Table 3. Collinearity statistics.

Factor	Tolerance	VIF
VR_education	0.860	1.163
VR_entertainment	0.777	1.288
VR_MKCOMP	0.985	1.015
CB_MK_VR	0.843	1.187

The Chi-squared ratio test (df:4) resulted in a value of 53.402 (p = 0.000) for the fitted model information, indicating a satisfactory model fit (Table 4). The results reflect a statistically significant improvement in fit compared to the intercept-only (null) model. The value for Cox and Snell R-square = 0.113 is acceptable. The Cox and Snell R-square value of 0.113 indicates a modest explanatory capacity. As a pseudo R-square, it cannot be interpreted in the same way as the R-square in linear regression and has limitations in logistic regression.

Additionally, the model's projected percentage of correctness was 66.9%, explaining 15.4% of the variance in VR (Nagelkerke R-Square). The Hosmer–Lemeshow test [Chi-square (df:6) = 5.271 df = 8, p-value > 0.05 (=0.510)] determines if event and non-event rates within population subsets differ from those that are observed. The test revealed that the deployed model fit the data.

Table 4. Model fit tests.

Tests	Outcomes
Omnibus Tests of Model Coefficients	Chi-square = 53.402; df = 4; *p*-value = 0.000 $p < 0.001$
Pseudo R-Square	−2Log likelihood = 534.206; Cox and Snell R-square = 0.113; Nagelkerke R-Square = 0.154
Hosmer and Lemeshow Test	Chi-square = 5.271, df = 6, *p*-value = 0.510 (>0.05)
Area Under the ROC Curve	Predicted probability: 0.704

4.2. Model Results

In the multivariate binary logistic regression, we used VR as the dependent variable (Table 5). Taking into account the first question (Have you used virtual reality tools?), the findings reveal that all four variables are significant at the 95% confidence level, with *p*-values below 0.05.

Table 5. Binary multivariate logistic regression results; VR as dependent variable.

Factor	β	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)
VR_education	0.413	0.161	6.629	1	0.010 ***	1.512	1.104–2.071
VR_entertainment	0.654	0.328	3.969	1	0.046 **	1.922	1.011–3.656
VR_MKCOMP	1.082	0.268	16.253	1	0.000 ***	2.951	1.744–4.993
CB_MK_VR	0.253	0.115	4.858	1	0.028 **	1.288	1.028–1.613
Constant	−1.481	0.344	18.500	1	0.000 ***	0.227	

Note: *** Significance at the 1% level, ** at the 5% level.

The variable VR_education was revealed to significantly impact VR [β = 0.413; Exp(β) = 1.512; *p*-value = 0.010]. Since the standardized β values in Table 5 are scale-free, comparing the relative strengths of effects among the variables in the same model is possible. The odds ratios offer managerially helpful information about how much a change of one unit in the relevant variable raises or lowers the likelihood that VR use would be selected or considered (Santoso et al., 2020; Azzam et al., 2024). The model's results indicated that the probability of using VR tools increases by 1.512 times when using VR in education. This shows that VR is important for education, providing new opportunities regarding the participation of Gen Z members.

As shown in Table 5, the effects of the second variable, VR_entertainment, are significant on VR [β = 0.654; Exp(β) = 1.922; *p*-value = 0.046]. The findings show that, when all other variables are held constant, the use of VR in entertainment boosts the likelihood of VR by 1.922 times. This shows that VR is important for entertainment, offering immersive activities that attract Gen Zers.

According to the results, there was a significant association between VR and the variable VR_MKCOMP, which measures if VR will change companies' marketing approach [β = 1.082; Exp(β) = 2.951; *p*-value = 0.000]. Among the four explanatory variables included in this model, VR_MKCOMP has a stronger influence on VR use within this specific context. The odds ratio of VR_MKCOMP indicates that the likelihood of VR use increases by approximately 2.951 times for those who believe it will change how companies approach marketing. These results highlight the potential of VR technologies to transform companies' marketing strategies.

The fourth variable used in this model was also significant, namely CB_MK_VR [β = 0.253; Exp(β) = 1.288; *p*-value = 0.028]. These results show that CB_MK_VR increases the likelihood of VR by 1.288 times, preserving other factors constant. This shows that

VR can influence consumer behavior, representing a technology that can be used for persuasive purposes.

5. Discussion

The results explain interesting insights regarding why Gen Z uses VR. It is claimed that VR will revolutionize the Gen Z lifestyle, and its specific tools will be easily integrated into their daily life. In the previously mentioned multivariate binary logistic regression model, we introduced the following predictors: the use of VR in education (VR_education), VR in entertainment (VR_entertainment), VR as a tool that changes the way companies approach marketing (VR_MKCOMP), and VR as a tool used in marketing activities that change consumer behavior (CB_MK_VR).

The strongest predictor for the use of VR by Gen Z was 'VR_MKCOMP'. Furthermore, 63.1% of the respondents from Gen Z appreciated that VR would change how companies approach marketing by creating immersive marketing experiences, 43.2% through demonstrations or test sessions for products or services in the virtual environment, and 32.2% through the customization of marketing experiences (Figure 2).

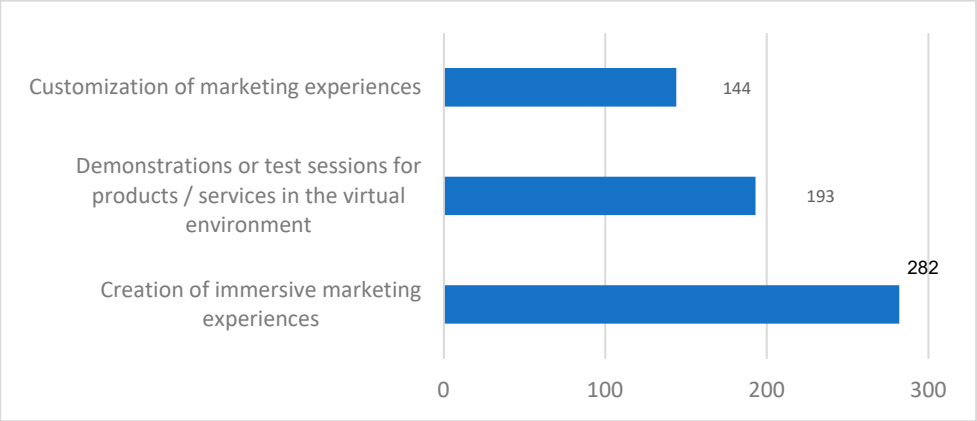

Figure 2. How will VR change the way companies approach marketing?

The products or services that would benefit the most from the use of VR in marketing strategies are as follows: video games (60.4%), tourism and travel (56.2%), electronic products (53.5%), real estate (37.1%), fashion and accessories (34.5%), and events and entertainment (34.5%) (Figure 3). Notably, products or services that would benefit most from VR in marketing reflect Gen Z's interest in VR-enhanced consumer experiences in specific industries. Consequently, the results confirm the third hypothesis, H3: Gen Z is more likely to believe that VR will change companies' marketing approaches than not believe it. Even if the previous studies are not explicitly applied to Gen Z, our findings are in line with the results from the literature (Branca et al., 2023; Tang et al., 2023; Zeng et al., 2023).

The respondents were asked to choose from a list of the main advantages of using VR in marketing (Table 6). The results indicated that Gen Z mainly considered VR important in marketing campaigns because it provides captivating experiences where consumers can interact with products or services in a virtual environment (66%), the customization of marketing experiences according to the preferences and individual behaviors of consumers, which can increase engagement and relevance (45.6%), and consumers' exploration of products or services in detail, without touching them (40.9%).

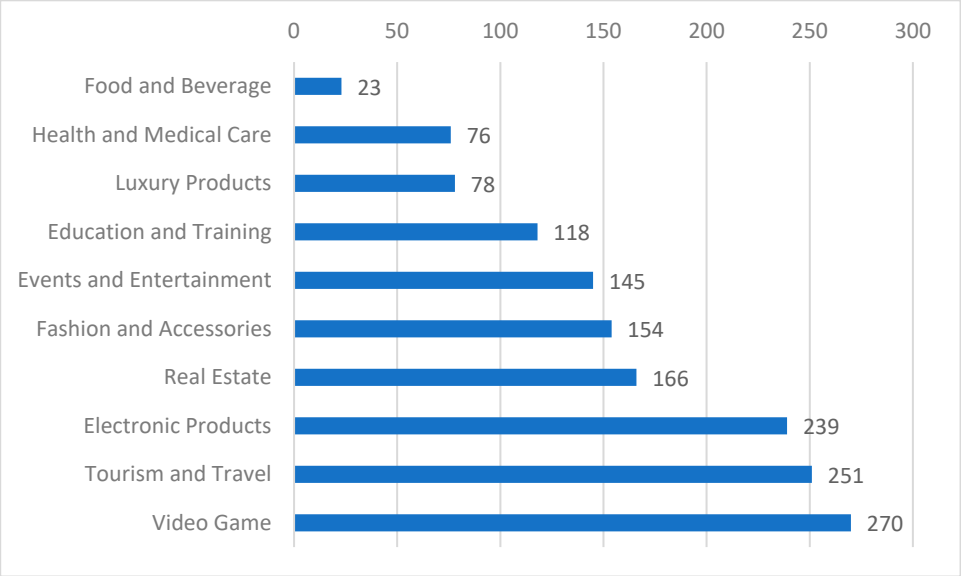

Figure 3. Types of products or services that would benefit the most from the use of VR in marketing strategies.

Table 6. The main advantages of using VR in marketing.

Displayed Opinions	Total	%
Captivating experiences where consumers can interact with products or services in a virtual environment.	295	*66.0*
Customization of marketing experiences according to consumers' preferences and individual behavior can increase engagement and relevance.	204	*45.6*
Consumers explore products or services in detail without touching them.	183	*40.9*
Reducing geographic barriers allows consumers to participate in events or interact with products without being physically present.	148	*33.1*
Obtaining instant feedback from consumers regarding products or experiences presented in VR, providing valuable information to improve the offer.	147	*32.9*
Differentiating the brand from the competition offers an innovative and modern element which can attract and retain consumers' attention.	143	*32.0*
Generation of viral content, with users sharing their captivating experiences on social media platforms.	116	*26.0*
Stimulating user engagement causes them to spend more time engaging with content.	91	*20.4*
Increasing information retention is important because users are involved more deeply and interactively.	88	*19.7*
Low costs compared to physical experiences.	68	*15.2*

These findings show the importance of immersive experiences in marketing. Sectors like video games, tourism, and electronics should prioritize VR use in marketing efforts. Tools can be used like virtual showrooms or interactive VR experiences for travel destinations. By providing the possibility to explore products virtually, companies can capture Gen Z's engagement, enhance satisfaction, and foster loyalty.

Gen Z is motivated to use VR for entertainment. The 'VR_entertainment' variable is the second strongest predictor of VR use. The results obtained are similar to those in other studies (Chirico et al., 2015; Kim, 2016; Hock et al., 2017; Powell et al., 2017; Schlacht et al., 2017; Abdelmaged, 2021). Education, and also corporate and government training, can be connected with VR entertainment (Zyda, 2005).

Gen Z members used VR glasses (58.8%) as the most common VR tool. This behavior highlights the preference for immersive experiences. The other instruments had less interest

for them, namely motion controllers (17.1%), VR simulators (10.1%), VR software (7.6%), and VR cameras (4%) (Figure 4). Consequently, the second hypothesis, H2: Gen Z's likelihood of using VR increases with higher self-reported engagement in entertainment activities, was validated. VR experiences are a subcategory of entertainment, and the term immersive entertainment is used (Burt, 2019; Lemle et al., 2015). This is about a digital world with unique experiences (Williams, 2014).

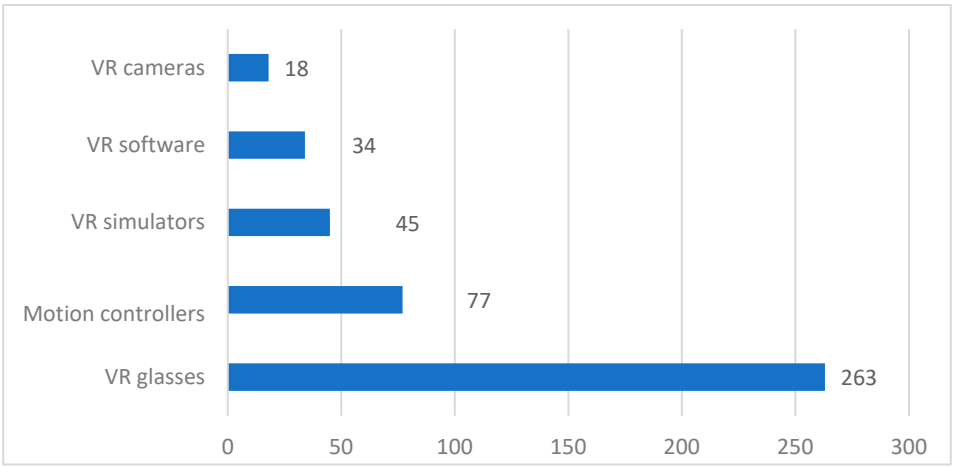

Figure 4. VR tools used by Gen Z.

Gen Zers' preference for VR in entertainment helps to understand their behavior. Thus, entertainment businesses can focus on developing VR content related to virtual concerts or interactive live events, increasing customer engagement and obtaining an important position in the industry.

The third most powerful predictor was VR usage for educational purposes. These outcomes correspond with the former findings (Campos et al., 2022; Paszkiewicz et al., 2021; Wee et al., 2022; Al-Ansi et al., 2023; Marougkas et al., 2023). Consequently, we can conclude that H1: Gen Z is more likely to use VR for educational activities compared to not using it was validated. H1 shows that Gen Z uses VR in educational activities. This increases the chances of being more attracted by new and innovative technologies. Gen Z is drawn to technology because they were raised with it and enjoy learning through interactive, visual, and technological tools (Mardoyo et al., 2023).

The primary benefit of VR in education is its capacity to offer users experiences that would not be feasible otherwise, promoting experiential learning and raising student engagement and motivation (Portuguez-Castro & Santos Garduño, 2024). VR provides significant advantages in terms of skill development, engagement, and learning outcomes (Muzata et al., 2024). Student engagement is influenced by how immersive the VR experience is. This shows how effective VR is as a teaching and learning tool (Luke et al., 2024).

VR-based educational activities attract members of Gen Z. Student engagement and learning outcomes can be increased by offering applications such as simulations, virtual tours, etc. Thus, institutions that implement VR in education will attract and retain Gen Z students.

Also, the perception that consumer behavior changes due to exposure to VR content in marketing activities represents a strong motivator for Gen Z to use VR tools. VR is one of the tech megatrends that will significantly affect consumers' lives and activities since customers experience a fuller picture of the VR store and a more intense sense of presence due to their satisfaction (Branca et al., 2023).

The main change identified by Gen Z in consumer behavior due to exposure to VR content in marketing activities was "increased product awareness" (34.5%). This was

followed by "making more informed purchasing decisions" (29.1%), "increased trust in product quality" (28.9%), and "providing more detailed and relevant feedback" (23.5%). In the last places are "a strong impulse to purchase" (18.8%) and "increased information retention" (10.5%) (Figure 5). Considering the previous arguments, hypothesis H4, Gen Z is more likely to perceive that VR content in marketing activities influences consumer behavior if they use VR compared to not using it, is validated.

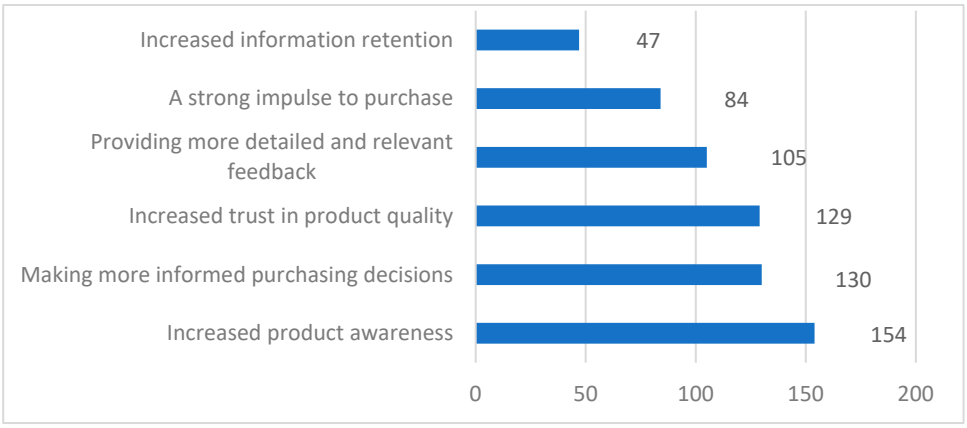

Figure 5. Changes in consumer behavior due to exposure to VR content in marketing activities.

As stated, even if previous research is not necessarily applied to Gen Z, our findings are in line with the literature (Farah et al., 2019; Yung et al., 2021; Geng et al., 2022; Godovykh et al., 2022). VR will significantly alter consumers' expectations when it comes to shopping because VR stores are not limited by opening hours (Peukert et al., 2019).

Consumer behavior can be influenced by VR. Consumer engagement and satisfaction can be increased by VR-based shopping platforms. These can offer virtual try-ons, product demonstrations, and interactive experiences. Consumers can make informed decisions, exploring products virtually, without restrictions.

6. Conclusions

This paper focused on factors influencing Gen Z's perceptions of VR's capabilities in education, entertainment, and marketing. Gen Z is more likely to use VR for educational activities. Organizations and specialists in the academic field frequently underline that VR technology can transform training and education by efficiently measuring students' skills and immersing them in realistic scenarios. Despite specific unfavorable results regarding their impact on anxiety, cognition, creativity, gender disparities, learning attitudes, learner satisfaction, and engagement, VR technologies significantly and positively influence educational outcomes (Yu, 2021).

Members of Gen Z are attracted to technology and interested in using VR in educational activities. The findings are in line with previous studies (Campos et al., 2022; Paszkiewicz et al., 2021; Wee et al., 2022; Al-Ansi et al., 2023; Marougkas et al., 2023). Gen Zers have this behavior because they grew up in a time with technological development. Thus, they prefer learning methods that are technology-based (Mardoyo et al., 2023).

Immersive educational programs harness VR capacity to transform learning. The use of VR could enhance learning and encourage engagement. Lessons can offer hands-on experiences, such as lab experiments or site visits. VR can be used in diverse fields such as medicine, engineering, and architecture. Thus, investment in VR infrastructure and staff training are important.

Gen Z members can experience new forms of entertainment through VR. This technology is used in entertainment by various generations. VR offers new opportunities to be

immersed in various media (Hamad & Jia, 2022), representing the evolution of entertainment. VR technology is accepted mainly due to the entertainment domain. This emphasizes the possibility of providing engaging user experiences (Hartmann & Fox, 2021).

VR used in entertainment attracts Gen Zers because it offers unique experiences. This is in line with previous research on the role of VR in entertainment (Chirico et al., 2015; Kim, 2016; Hock et al., 2017; Powell et al., 2017; Schlacht et al., 2017; Abdelmaged, 2021).

Gen Zers are interested in virtual concerts and VR-based games. Event organizers and gaming companies can develop avatars in games or increase interaction within virtual concerts. This approach can increase engagement.

VR can change companies' marketing approaches, according to Gen Z members. Our findings are in line with the broader conclusions from previous research, even if those works were not focused on Gen Z (Branca et al., 2023; Tang et al., 2023; Zeng et al., 2023). VR use in marketing can help businesses to achieve their goals (Kostyk & Sheng, 2023). Also, it can provide audiences with valuable content.

Using VR in marketing involves developing immersive product demonstrations and virtual tours. Thus, customers can explore product features with the help of VR, and test products, thus strengthening engagement with the brand. Also, developing interactive virtual tours of production facilities can boost consumer trust.

Customer behavior and product perception can be influenced by VR (Grudzewski et al., 2018). Customers can have unique experiences due to the use of VR in marketing, which influences buyer reactions.

VR can have an impact on consumer behavior, according to Gen Zers. Our findings are in line with the general conclusions from previous works, even if they were not focused on Gen Z (Farah et al., 2019; Yung et al., 2021; Geng et al., 2022; Godovykh et al., 2022).

Marketing strategies can be improved by using VR. Thus, customer engagement can increase by investing in VR tools and platforms. These can be used for product testing, virtual store tutorials, product customization, and real-time feedback.

According to the Technology Acceptance Model (TAM), perceived usefulness is a factor that explains technology adoption behavior. Gen Zers recognize the usefulness of VR in education, entertainment, and marketing. This fact contributes to Gen Z's acceptance of VR. However, future research should consider other factors that may influence Gen Z members, such as social influence.

The theoretical contribution of the study refers to the analysis of the factors that determine the adoption of VR by Gen Zers in Romania. The econometric model used has identified the predictors of VR adoption.

The practical contribution underlines measures that can be adopted in the three areas to attract Gen Zers. Thus, through captivating learning experiences, and the development of unique and interactive VR content, the involvement of members of this generation can increase.

The limitations of the study relate to the focus on members of Gen Z in Romania, using a small sample size. Another limitation is brought by the sampling method, which may not reflect the diversity of Gen Z members. Therefore, the results cannot be generalized. Also, the term "Gen Z" was used in the paper, but the findings apply only to the sample studied.

The questionnaire used to collect the data may have limited the respondents' ability to express their thoughts and ideas. However, the responses and results obtained may highlight Gen Zers' interest in VR.

The lack of open-ended questions in the questionnaire limited the ability to capture personal insights, which might have enriched the understanding of respondents' views.

Further research on this topic is warranted, preferably with a more extensive and diverse pool of respondents. An important approach could be the use of open-ended ques-

tions in the developed questionnaires. Also, another research topic could be the analysis of the challenges that emerge from producing VR content, including production costs. An emphasis could be placed on researching how companies evaluate the effectiveness of VR marketing campaigns. For a clearer picture of the determinants, future work could also focus on analyzing the potential moderating effects of demographic variables on VR adoption.

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Institutional Review Board Statement: This research was developed based on a survey on VR use. The questions were designed to collect opinions and perceptions, and no personal data were collected. Participation in the survey was voluntary, with the possibility of withdrawal at any time, without consequences. This work does not pose a risk to participants. Therefore, ethical approval from an institutional review board or ethics committee was not required for this study.

Informed Consent Statement: Informed verbal consent was obtained from all participants in this study.

Data Availability Statement: The data used in this study are available at https://doi.org/10.6084/m9.figshare.26266166.

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