# HOW NEW TECHNOLOGY IN SPORTS IMPACTS FAN ENGAGEMENT

by

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# ABSTRACT

The integration of Augmented Reality (AR) and Virtual Reality (VR) technologies, collectively referred to as Extended Reality (XR), has gained significant traction in the sports industry. This research investigates the impact of XR on sports fan engagement, with a particular focus on how these technologies influence different generational cohorts. A conceptual model is proposed, suggesting that Generation Z individuals exhibit stronger identification with sports teams compared to older generations. This enhanced loyalty, leads to the hypothesis that they perceive greater enhancement of their sports experience through XR technologies. Consequently, XR interventions may incentivize Gen Z's attendance at live games by providing immersive and interactive experiences. To test this conceptual model, a quantitative survey was conducted with 218 respondents across various age groups. The findings revealed a significant positive relationship between Gen Z individuals, sports team identification, and perceived enhancement through XR experiences. Furthermore, an indirect effect was observed, wherein Gen Z's stronger team identification and perceived enhancement through XR indirectly influenced their willingness to attend physical sports games with XR features.

The study contributes empirical evidence to the growing field of XR research in sports and offers theoretical insights by building upon the literature on sports team identification. It provides practical implications for stakeholders in the sports industry, including teams, leagues, broadcasters, and marketers, by examining the current landscape of XR advancements and their integration within the realm of sports consumption. Limitations of the study and avenues for future research are addressed, highlighting the need for continued exploration into the complex interplay between technology, generational trends, and sports fandom.

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# INTRODUCTION

While the concept of augmented reality (AR) seems to only recently emerged in prominence in the realm of sport entertainment and marketing, it has held a significant presence in the field for quite a long time. In 1998, the first ever example of Augmented Reality (AR) debuted during the Bengals vs Ravens NFL game with the "Yellow Line" or better known now as the "1st and Ten line". ESPN was the only network to take this risk, spending $25,000 to bring their fans a new innovative technology and improve their viewing experience by stretching a digitally engineered paint line across the entire length of the field. The "Yellow Line", indicating where the first down marker lays without being distracting, was invented by SportsVision using a 48ft semi-truck parked behind the stadium in to ensure every single pixel on the TV screen corresponds to the exact location on the field and working in real time to do color corrections based on field conditions and camera angles. Since then, this technology became a staple in almost every single football game on every broadcasting network. In 2001, when Fox Sports tried to cut costs and remove the virtual line, the network faced major backlash, resulting in them bringing back the audience-beloved line. In sports these days, this technology is ubiquitous in the forms of virtual line referees, scannable QR codes, immersive esports experiences, and more digital AR overlays in almost every sports game.

AR in sports have accelerated and gained much traction recently as Artificial Intelligence (AI) grows more popular and large tech giants like Apple and Microsoft launch their Virtual Reality (VR) headsets into the market. Innovation is changing all aspects of sports before, during, and after the game. The addition of sports broadcasting and streaming has significantly expanded the reach of sports. The ability to watch live and recorded games, track players stats

and highlights, and follow teams through social media accounts has allowed sports fans more comprehensive viewership and engagement. Underlying the massive investment in AR and VR technologies in sports is the sport teams and organizations (e.g., NFL, NBA, etc.)'s strong drive keeps their fanbase engaged and devoted. In fact, the sports industry is growing faster than the global GDP with revenue streams from games and events but also commercial aspects like catering, memorabilia, image rights, construction projects, and broadcasting (Brandy et al., 2022). In total, the sports entertainment industry is a $185 billion dollar business and only continuing to grow especially with large sporting events such as the Superbowl, March Madness, and the Olympics which drives billions of dollars and major increase in fan viewership (PlayToday, 2024). North America accounts for 16.4% of the global sports market with NFL, NBA, and the MLB being top revenue generators (PlayToday, 2024). However, while this number is growing, it is in large part due to other contributors such as sports media, sports betting and esports emerging (USDA, 2019). TV broadcasting contracts are a top contributor and significantly add to the revenue streams of top leagues such as the NFL, NBA, and MLB (USDA, 2019). Companies such as ABC, which own ESPN, NBC, CBS, FOX5, Amazon, and many more pay millions to sports clubs for the right to stream their events (NYT, 2024). While this is the largest source of income for the sports clubs, in-person stadium games are crucial for sports teams. Pro Sports teams stadiums range from 53,000 to 93,000 seats with the average price hitting around $150 not yet including the price of food, drinks, or other in-game amenities (Geoshen, 2018). In addition, physical attendance helps build the teams' spirit and culture, retaining fans' loyalty and engagement (Previati, 2020). However, in recent years, physical fan-based revenue, encompassing all the sales generated by fans who physically watch the games stadium, including ticket sales, concessions, parking fees have otherwise stalled (USDA, 2019).

While sports teams and organizations are investing a significant portion of their budget in AR/VR technology (CNBC, 2020), a critical question remains as to how these technologies help improve experience and fan engagement, and especially physical attendance. Sports fans are not restricted to a particular time or location to watch their favorite team but can now broadcast through streaming services like ESPN+, Hulu, or YouTube TV. Gen Z, the digital natives—those who were born after 1997, have only ever grew up with this technology surrounding them. They haven't watched a football game that doesn't use the iconic yellow line or had to wait to catch the stats of their favorite game. They can pull up any game they want on any network with all the available streaming services on their phones and TVs. It seems that investment in AR and VR was intended to help sports teams attract new younger fans by focusing on the entertainment value and provide more interactive and rewarding experiences to keep their audience base growing (Deloitte, 2023).

On the one hand, Millennials and Gen Z fans, accustomed to technologies, might want a more immersive, customized, and personalized sports viewing experience so it is important to focus in on how sports organizations can achieve this to succeed long term to keep fans engaged longer which will therefore boost revenue and grow sales. From 2022 to 2023, the global sports market grew a compound annual growth rate of 5.2%, reaching over $512.14 billion in revenue (PlayToday, 2024). Imagine being able to completely take control over the game experience and choose not only what to watch but also when, where, and how to create a completely unique and personalized sports reality. No two fans will be experiencing the same game in the same way. Now picture a fan that has just left their seat to refill their drink and completely missed the final homerun of their favorite team and show up minutes after they finish doing the final replay. Well now, with new advanced and personalized technology measures such as MLB's Gameday 3D,

fans can not only see a detailed look at the replays but also actively experience the action with 3D animations, watching the game from any angle: behind home plate, standing on the pitchers' mound, bird's eye view of the stadium, or following the runners as they hit all four bases and experience the winning homerun first hand (Sports Business Journal, 2023). This is only one example in the race to create innovation and capture audience's attention. Younger fans are looking for new ways to engage sports that aren't the traditional ways of viewing. Consequently, there is importance in using captivating content such as AR graphics, virtual studios, and sports analysis tools with 77% of younger viewers claiming this is essential to them (NY Post, 2023).

On another hand, recent data has indicated a downward trend for physical attendance among younger audience. Sports leagues have seen its young audience trend downward for six straight years (The Washington Post, 2020). A report by the New York Post also revealed that all generations of fans prefer to watch sports at home alone with 43% being Gen Z (NY Post, 2023). There has been a rapid decline in the popularity of live sports as more streaming services become available and offer innovative technologies with more ways to view their content. These younger generations are looking for more interactive, engaging, and shorter game experiences. For example, in 2023, MLB made significant rule changes which shorten the pitch clock to make the innings shorter and decrease the number of mound visits (ESPN, 2024). The game is starting to adapt to new generations and their viewing habits as they cannot afford to lose an entire generation of fans that is not receptive to older traditional ways of viewing. Sports organizations need to understand how to continue to grow and drive engagement amongst the younger generation to generate profits and lasting loyalty amongst their fans because if their sports identities and connections aren't formed while they are young, sports team loyalty and engagement will likely disappear in their future. In this aspect, does AR/VR help leverage sports

team loyalty and retain or increase physical attendance among audience, especially younger generation sports audience? This remains an unanswered empirical question, as the literature in this newly prominent domain is still relatively limited.

The primary objective of this research paper is to investigate the impact of Extended Reality (XR—which is consisted of AR and VR) on sports fan engagement through a comprehensive research study and subsequent discussion. This paper aims to shed light on the intricate relationship between XR technologies—namely Augmented Reality (AR) and Virtual Reality (VR)—and the behaviors and experiences of sports enthusiasts. Through a quantitative approach and thorough analysis and discussion, the paper seeks to elucidate whether XR interventions augment or transform traditional modes of fan engagement. In doing so, not only does it contribute empirical evidence to the growing field of XR research in sports but also offers theoretical insights by building from the rich literature in sports team identification. Furthermore, by examining the current landscape of AR and VR advancements and their integration within the realm of sports consumption, the paper provides practical implications for stakeholders in the sports industry, including teams, leagues, and broadcasters. Ultimately, this research seeks to contribute to a deeper understanding of the evolving dynamics between technology and sports fandom, thereby informing future strategies and innovations in both domains. The remainder of this research is organized as follows. First, I delve into the literature to build a conceptual model. I then propose and conduct an empirical survey to test the conceptual model, analyze and discuss the results and its implications as well as limitations.

# CONCEPTUAL DEVELOPMENT

## EXTENDED REALITY IN SPORTS

This research focuses on the concept of Extended Reality (XR) which encompasses both Augmented Reality (AR) and Virtual Reality (VR). AR adds to the real world with digital elements. It is the integration of digital information and 3D components with the user's perception of the real world in real time. It offers visual elements, sounds, and other sensory effects through everyday devices like smartphones and TV. AR overlays real-time statistics, player information, and graphics onto live broadcasts or stadium experiences. For instance, in the NFL, 3D positions of all players and the ball at high frame rates are being tracked and then used for fans benefit as there are more detailed stats to follow their favorite athletes and they can track them throughout a game. Additionally, basketball organizations are combining computer vision with machine learning to provide more accurate metrics such as shot accuracy, speed across court, vertical jump distance, speed, and ball release.

Virtual reality (VR) immerses the user in a completely artificial simulated environment created with software and primarily experienced through the use of a VR headset with both full sight and sound effects (Noury, 2020). Examples of this are the new Apple Vision Pro and Meta Quest 3 headsets that launched within the past year. Users are placed inside a 3D environment where they are able to move around and interact with the generated surroundings. These technologies have been around for years, however, have been growing rapidly due to popularity and familiarization of similar technology in apps such as Apple Navigation, Snapchat, Pokémon Go, and gaming devices. In sports, VR enables fans to experience events as if they were physically present with 360-degree views of the venue from multiple vantage points and

perspectives. VR provides a unique advantage for sports leagues and broadcasters looking to create more intense and engaging fan experiences compared to 2D videos since it provides the most spatial presence, immersion, and perceived realism for the viewers (Jung et al., 2021).

XR has become an integral component of modern sports, revolutionizing how fans interact and engage with their favorite teams. With the use of AI and data analytics, new augmented and virtual reality experiences are being created to enhance quality, interactivity, and personalization with immersive game experiences, interactive stadium technologies, and behind the scenes access and new sponsorship opportunities (McCarthy, 2020). These technologies have transformed user experience allowing fans to further connect with their teams in ways that were never previously available. Companies and organizations within the sports industry such as sports leagues, broadcasters, technology and marketing firms, advertisers, and more are investing significantly in XR technologies as they grow increasingly popular to enhance fan engagement and create memorable sports experiences, improve player performance, and overall find new ways to increase revenue. Sports organizations are investing billions in sports technologies with the global virtual sports market reaching over $16 billion USD in 2023 (Precedence, 2023). This growth reflects the ongoing advancements and improvements in technology as users seek high quality engaging sports experiences, the accessibility to smartphones and mobile devices, and integration with esports and betting services.

## Sports Fans Engagement and Physical Attendance

While fan engagement and loyalty are similarly related concepts, they still represent drastically different aspects in the context of sports. Fan engagement between the sports organizations and fans refers to their interaction, involvement, and connections (Vale, 2017). It is

how fans actively participate such as by attending games, watching broadcasts, attending fan events, following their teams on social media and mobile apps, and purchasing team sponsored merchandise. It encompasses how often, and likely fans are to invest their time and effort into a sports team and actively express their passion for it (Balamurugan, 2021). The level of fan engagement is important for sports organizations as it shows who is interested and willing to spend their time and money investing in sports which can be seen and impacted through ticket and merchandise sales, game attendance, and overall team image. Fan loyalty on the other hand is much more emotional and lasting commitment to a sports organization and team. The connection is deeper and harder to break as there is strong tie usually coming from past ties or allegiances. There is a commitment to the team regardless of any negative performance or image. These fans are much less likely to switch their allegiance and support another team as there is a sense of community and belonging to their team (Bauer, 2008). This can be seen through consistent game attendance particularly with season tickets, extensive investment in team merchandise or sponsorship, and active engagement on social media supporting their teams. While fan loyalty may be harder to measure, it is a very valuable asset to sports organizations as it can highlight their stable fan bases who will provide consistent revenue and support to their teams. Perceived quality and brand engagement are key influencing factors of brand loyalty and actual purchase behaviors for fans for sponsored products (Manoli, 2018). Both concepts are important for sports teams' success and their lasting impact.

In this research, I argue that physical attendance at sports events serves as a robust proxy for both fan loyalty and engagement. The decision to attend a game involves significant commitment and investment from fans, encompassing both financial expenditure and time (Lintumaki et al., 2024). As such, attending a game is not only a demonstration of a fan's support

for a team but also an indicator of their willingness to engage in the social and communal aspects of fandom. In addition, fans who regularly attend games are more likely to exhibit other forms of fan engagement behaviors, such as purchasing merchandise, participating in fan-related activities online, and consuming team-related media outside of the game itself (Manoli, 2018). These activities contribute to the broader ecosystem of fan engagement, reinforcing the fan's identity and connection to the team. Moreover, physical attendance helps strengthen communal bonds among fans, fostering a shared identity and collective memory associated with their experiences at games (Wann, 2006). These aspects are crucial for the sustained growth and vitality of sports franchises, as engaged and loyal fans are more likely to support their teams during both peak and challenging times. Thus, physical attendance is a critical indicator of sport teams' engagement and loyalty.

## SPORTS TEAMS IDENTIFICATION

Sports teams identification, the psychological bond individuals form with their favorite teams, plays a pivotal role in shaping fan behaviors, attitudes, and long-term loyalty within the sports domain. This paper explores the concept of sports team identification to explore its formation processes, significance in fostering enduring fan allegiance, and the factors contributing to variations in identification levels among individuals. Individuals derive a sense of self-concept and belonging from their affiliation with social groups, including sports teams (Tajfel & Turner, 1979). This identification is cultivated through various mechanisms, including exposure to team-related stimuli, socialization processes within peer group and families, and emotional connections forged through shared experiences and victories (Wann, 2006). Furthermore, research found that sports fan ship often begins early in childhood where ties in

sports are made primarily through family connections (Dietz-Uhler et al., 2000; Gantz et al., 2008). Then fanship peaks in college age and declines in later years as individuals begin to take on more identities with greater strength and tend to lose their weaker identities due to lack of time, shifting priorities, and increasing maturity that led to decreasing passion and dependency on group affiliation (Dietz-Uhler et al., 2000; Gantz et al., 2008). Sports teams identification serves as a cornerstone of fan loyalty, exerting a profound influence on individuals' attitudes, behaviors, and consumption patterns in sports. High levels of team identification are associated with greater emotional investment in the team's success or failure, increased attendance at games and events, heightened engagement with team-related media content, and elevated likelihood of purchasing team merchandise (Wann, 2006). Moreover, research indicates that team identification fosters a sense of community and camaraderie among fans, facilitating social interactions and collective celebrations that strengthen the bond between individuals and their favorite teams (Trail et al., 2003). Consequently, sports organizations need to prioritize cultivating team identification among their fan base as a strategic imperative for fostering enduring loyalty and sustaining revenue streams. Despite the overarching importance of sports team identification, individuals exhibit varying degrees of identification with their favorite teams, influenced by variety of factors, Research identified demographic variables such as age, gender, and socioeconomic status as significant predictors of team identification, with younger, male, and higher income individuals generally exhibiting higher levels of identification (Wann, 2006). By understanding the formation and significant of how identification and formed and which demographics its most relevant in, sports organizations can develop target strategies to enhance overall fan experiences and cultivate a deeper level of loyalty. Team identification is the major determinant of fans' patronage intention and therefore sport organizations are

recommended to invest a substantial part of their resources on activities that generate long-term effects, such as trust in the team and team identification, rather than on short-term strategies such as attracting star players (Wu, 2012).

## GENERATIONAL DIFFERENCES

There exist significant generational differences in sports engagement as different age groups possess unique sports characteristics and behaviors including their technological preferences and perceptions of sports significance. Older generations, such as Baby Boomers and Generation X, often exhibit higher levels of sports consumption through traditional media channels, including TV broadcasts and live events (Kidd et al., 2008). In contrast, Gen Z, the digital native cohort, gravitates towards online platforms and streaming services for sports content consumption, leveraging social media platforms for real-time updates and interactive experiences (Wenner et all, 2017). While older sports fan, often possess greater disposable income and purchasing power, they are more likely to allocate their funds towards premium experiences such as season tickets, VIP packages, and memorabilia collections (Gibbs & Duke, 2021). This meaning that more time and money are spent on in person and physical sports consumption. Conversely, Gen Z individuals, while increasingly critical for sports fandom, exhibit preferences for cost-effective and convenient options, such as streaming and digital avenues (Cunningham et at., 2020). Despite the differences in sports consumption patterns and spending habits, sports hold enduring significance across generations, serving as a unifying force that fosters community, identity, and connections. As such, sports organizations must recognize the enduring appeal of sports and capitalize on this shared passion to foster a sense of unity and inclusivity among diverse audience segments.

## CONCEPTUAL MODEL

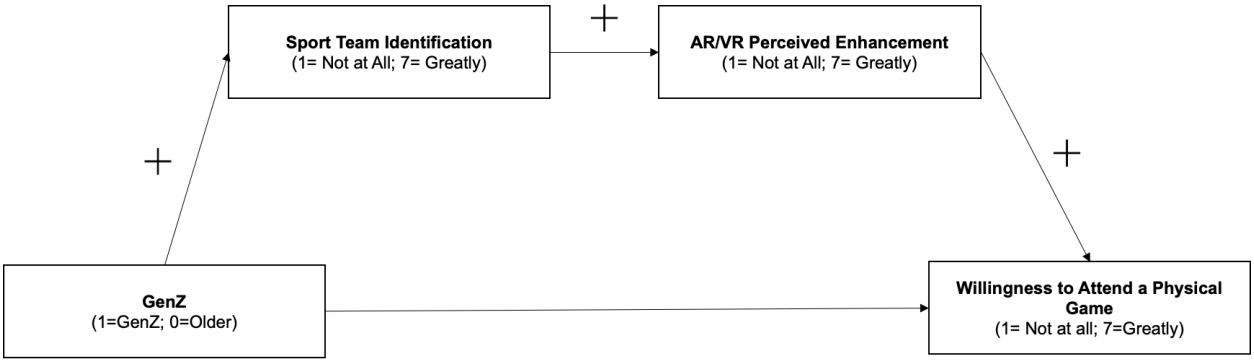
This paper focuses on the primary question of whether and how XR affect sports fan engagement, especially physical game attendance. Specifically, this paper argues that Gen Z exhibits a stronger identification with sports teams compared to older generations who have had more time to develop different identity attachments in life. This enhanced team loyalty among Gen Z individuals appears paradoxical given their digitally driven lifestyle, which diverges significantly from traditional modes of sports consumption. Traditionally, fans engaged with sports primarily through live attendance and television viewership. In contrast, Gen Z fans are more inclined to follow sports through digital platforms, including social media and streaming services, reflecting broader shifts in media consumption patterns across various content types.

Given their strong team affiliations and digital preferences, this research hypothesizes that Gen Z's sports experience could be significantly enhanced through augmented reality (AR) and virtual reality (VR) technologies. These technologies, by offering immersive and interactive viewing options, are uniquely positioned to bridge the gap between Gen Z's digital inclinations and their desire for deep sports engagement. AR and VR can transform passive viewing into an interactive experience, potentially heightening the emotional and sensory engagement with the sport, thus amplifying team loyalty, and enhancing overall experience.

Consequently, the integration of AR and VR into sports viewing experiences might not only cater to Gen Z's digital preferences but could also incentivize their attendance at live games. By providing augmented experiences, such as behind-the-scenes access, live statistics overlays, and other interactive features, AR and VR could make attending physical games more appealing to Gen Z. This attraction to enhanced experiences at live events could lead to a higher

propensity among this generation to engage physically, thus potentially reversing trends of declining live sports attendance among younger audiences. Figure 1 summarizes the main conceptual model and key hypotheses of this research.

**FIGURE 1: CONCEPTUAL MODEL**




## METHODS

To test the conceptual model positing that augmented reality (AR) and virtual reality (VR) technologies enhance sports engagement among Gen Z, I employ a quantitative research approach using a survey methodology. This method is particularly advantageous for several reasons. Firstly, surveys allow for the collection of data from a large and diverse sample of participants, which enhances the generalizability of the findings. Secondly, utilizing a survey facilitates the systematic measurement of variables defined in the conceptual model. Furthermore, the survey method enables the efficient gathering of data on the respondents' attitudes and perceptions, which are central to understanding how AR and VR may influence their engagement with sports. By including questions that assess participants' satisfaction with their sports viewing experiences and their intentions to attend live games, the survey can provide insights into the causal relationships posited in the model. Additionally, the survey approach

allows for the application of sophisticated statistical analyses to examine the relationships between variables. These analyses can not only validate the relationships posited by the conceptual model but also explore potential moderating and mediating variables that might influence these dynamics.

## SAMPLE

The sample utilized in this research study comprises a diverse group of individuals to explore the impact of XR on sports fan engagement. With 218 valid responses collected through a 20-content question Qualtrics survey sent out via shareable link to Facebook groups, school-based Group Me chats, text messages and emails, and LinkedIn. This sample represents a broad spectrum of sports enthusiasts spanning various demographics and backgrounds. The sample boasts a wide age range, with the mean age being around 42, with a standard deviation of 16 indicating the inclusion of individuals from different generations and levels of technological proficiency. The sample was also taken by 78% female users. Moreover, the sample is characterized by a significant representation of Gen Z individuals, constituting 68% of respondents. This demographic, born between 1997 and 2012, epitomizes the digital native generation as they were raised among rapid technological advancements and digital immersion. By understanding the perspectives and preferences of these demographics, stakeholders in the sports industry can gain valuable insights in the future trajectory of AR and VR and its overall impact on fan engagement to create more impactful strategies.

The survey was generally made up of sports fans as the friends, family, and acquaintances it was sent out via convenience sampling which allows for larger samples than traditional convenience samples and more heterogeneity (Leiner, 2016). Convenience sampling

is a type of nonrandom sampling where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at given time, or willingness to participate are included for the purpose of the study (Etikan, 2015). While this survey was sent out to a diverse range of demographics in different cities, different ages, genders, and income levels it still ran the risk of convenience sampling as the experiment was not performed under traditional and strict testing environment. The exploratory nature of this research question and the need to efficiently gather insights from a wide variety of respondents where time and resource constraints limited the feasibility of more rigorous sampling techniques. While this method of sampling may introduce biases inherent in any non-probability sampling methods, its utilization in this context allowed for the facilitated exploration of attitudes towards XR in sports engagement. The survey yielded informative results attributable to several factors and provided a substantial dataset for analysis to seek meaningful trends in sports fan identities and engagement with XR technologies among the different generations of sports fans.

## PROCESS & QUESTIONS

This section seeks to present the framework behind my research and data collection and analysis.

The survey used for this research will examine the correlation between AR/VR in the sports industry and participants' level of engagement as it related to age. It is meant to test if AR and VR technology that has been introduced into various aspects of sports is affecting user engagement levels in a positive or negative way and whether this will change fans viewing behaviors.

Upon entering the shareable link to the Qualtrics survey, recipients were taken to an introductory page which outlined the purpose of the study, the confidentiality of their responses, and their rights as participants. To ensure that each respondent only completed the survey once, the survey software tracked IP address to block duplicates. The survey consisted of 20 content-based questions along with three demographic questions at the end and took approximately ten minutes to finish. All participants of the survey came from varying backgrounds including different education levels, genders, areas of the country, and ages. The digital software that was used to conduct the survey was Qualtrics, and the survey questions and model appear in the Appendix. Included with the survey URL link, a mandatory consent form with a description of the survey purpose was distributed to participants. With their informed consent, participants proceed to the next stage, where they are invited to provide their email address for a chance to win a $25 Visa gift card, an incentive for participants to take the time and contribute to this research.

As respondents navigate further into the survey, they are provided with unaided examples of AR and VR in the form of real-world scenarios and presented with definitions to familiarize participants with the potential uses and benefits of these technologies. This helps set the stage for subsequent questions about their attitudes and perceptions towards these tools and offers a base line regardless of prior knowledge or lack of. The bulk of the survey lies in the series of questions divided into four distinct blocks designed to gauge participants familiarity with XR technologies, their attitudes towards integrating XR into sports experiences, their feelings of connectedness to sports teams and impact XR has, and lastly participants overall sports and technology behaviors. Respondents were presented with a series of statements or scenarios, ranging from 1 to 7, with 4 offering a neutral option, representing varying degrees of agreement

or disagreement. Questions that were pertinent to this study tested the effect of age on perceived AR/VR experience enhancement. After providing real life examples of AR/VR in sports, the survey asks participants to rate what changes (if any) have they noticed in their sports consumption engagement since the introduction of new AR/VR technologies on a scale of 1 (decreased significantly) to 7 (increased significantly). If further goes to ask respondents to rate the extent to which they believe AR and VR can enhance the sports viewing experience. The survey also tested the effects of age on sports team identification through a series of questions related to emotional connectedness to the game and sports teams. One question in particular was testing to see how much respondents thought their favorite sports organizations and players reflect their personal identity. Lastly, survey questions prompted respondents to answer if the use of AR and VR in sports games would affect their willingness to attend a physical game or pay extra for an AR/VR assisted game.

As participants near the conclusion of the survey they were asked to provide demographic information. It required respondents to answer their exact age, gender, and household income level to better contextualize and interpret the responses. These demographic questions were important as knowledge and understanding of new technology can differ greatly amongst different ages and generations, so this helped to avoid skewed results of only asking participants of one age group to take this survey. This also allowed deeper insights into how different generational groups perceive and interact with XR technologies in the specific context of sports.

Online participants then close the browser and indicate they have completed the survey. Participants that withdrew from the study were removed from the analysis. Before launching this survey and collecting any data, I pilot tested the survey with two individuals to ensure that all

questions were correctly presented, unbiased, could not be skipped, and invalid or duplicate data could not be submitted. I then administered the survey on the 1st of March 2024 and collected data until the end of March 2024. Data analysis was performed using Analysis of Variances (ANOVA) and regression-based mediation model (PROCESS Macro, Model 6, Hayes, 2012) to validate the conceptual model. The survey's instrument is included in the Appendix.

Thus far, this chapter has presented the methodology for collection of data for this study. The following chapters will present research findings, managerial implications, limitations, and recommendations for future research.

# RESULTS

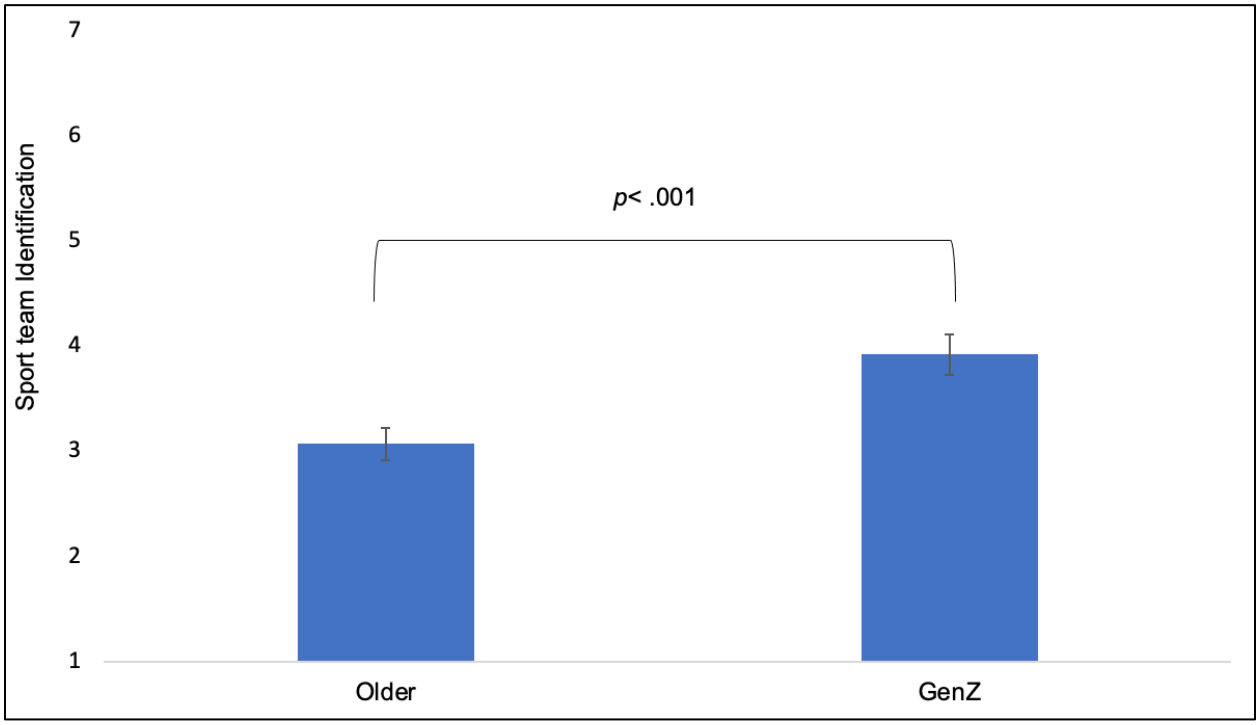
The results section of this research study examines the relationship between age, sports team identification, perceived enhancement through AR and VR, and willingness to attend physical games. I conducted a series of one-way ANOVA to examine the effect of Gen Z (vs. older) individuals on the levels of sports team identification, perceived enhancement through AR/VR experiences and willingness to attend a physical game. This section delves into the implications of these findings for understanding fan engagement dynamics across generational cohorts.

## MAIN EFFECTS OF GENERATION Z ON AR/VR EXPERIENCES

A series of one-way ANOVA of the effect of Gen Z (vs. older) on the AR/VR outcomes revealed an interesting pattern. First, results showed a significant main effect of Gen Z on sports team identification ($F(1,212) = 11.06$, $p < .001$, $\eta_p^2 = .05$), indicating that gen Z cohorts exhibit

higher levels of attachment and allegiance to their favorite sports teams more often than older generations. (See Figure 2).

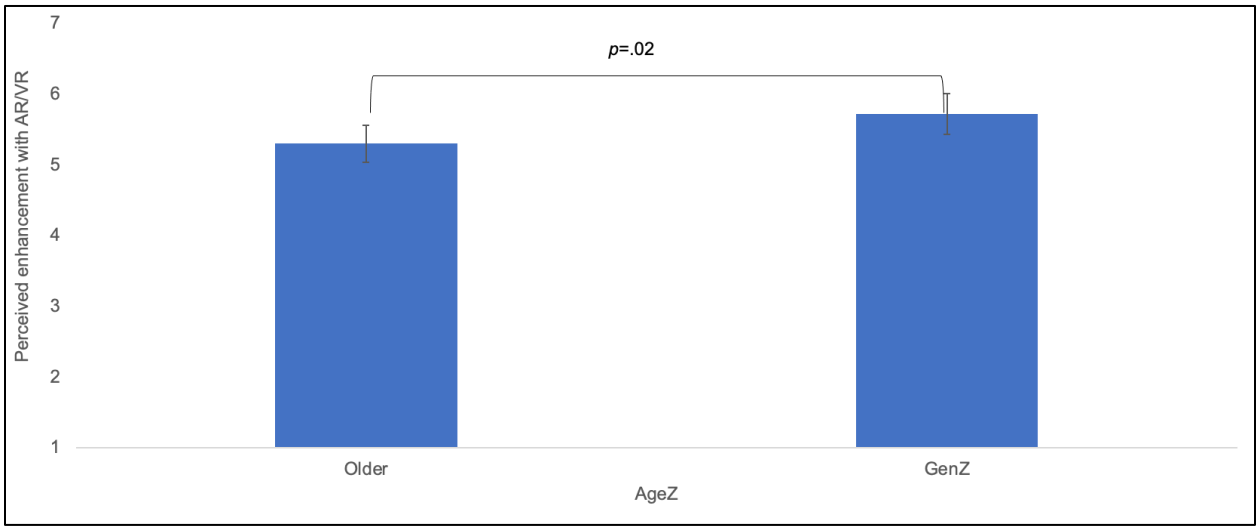
**FIGURE 2: EFFECTS OF AGE ON SPORT TEAM IDENTIFICATION**




Note: Error bars represent 95% CI

Second, the results also showed a significant main effect of Gen Z on perceived experience enhancement of AR/VR technology ($F(1,212) = 5.74$, $p < .001$, $\eta_p^2 = .03$), suggesting that belonging to gen Z plays a crucial role in shaping individuals' perceptions of the benefits derived from XR technologies in sports (see Figure 3).

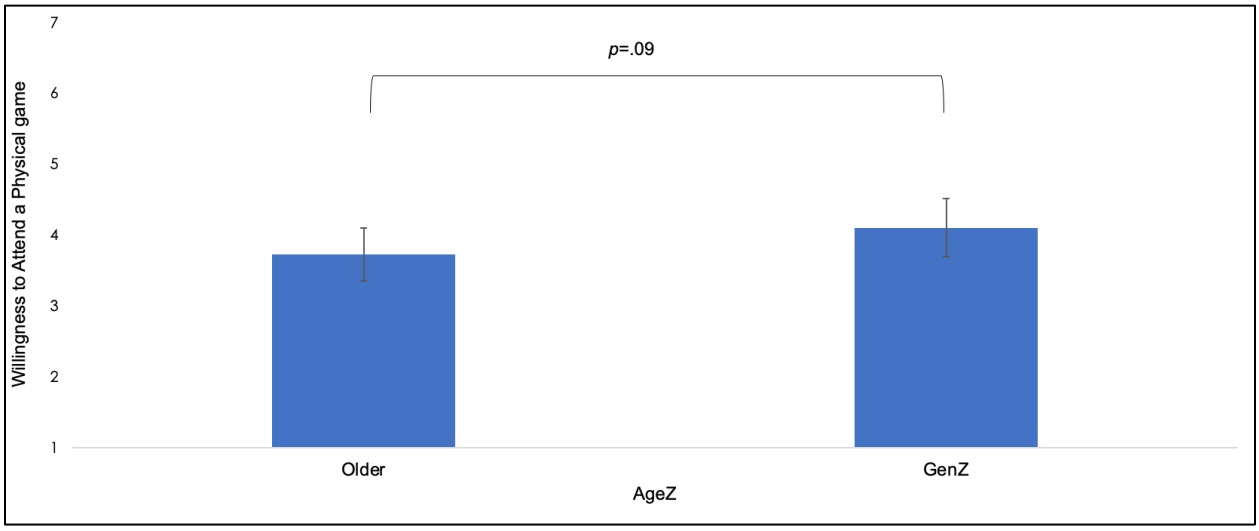
**FIGURE 3: EFFECTS OF AGE ON PERCEIVED AR/VR EXPERIENCE ENHANCEMENT**




Note: Error bars represent 95% CI

Finally, I also found a marginally significant effect of Gen Z on willingness to attend at AR/VR assisted physical game (F (1,212) = 2.83, p = .09, $\eta_p^2$= .01), showing that generational differences might also play a role in physical attendance in the AR/VR assistant sports space (see Figure 4). Although the effect is only marginally significant, my conceptual model proposes that Gen Z and perceived XR experience and its impact on physical game attendance might go through a mediation, indirect process. The following analysis tests my full conceptual model.

**FIGURE 4: EFFECT OF AGE ON WILLINGNESS TO ATTEND AN AR/VR ASSISTED PHYSICAL GAME**




Note: Error bars represent 95% CI

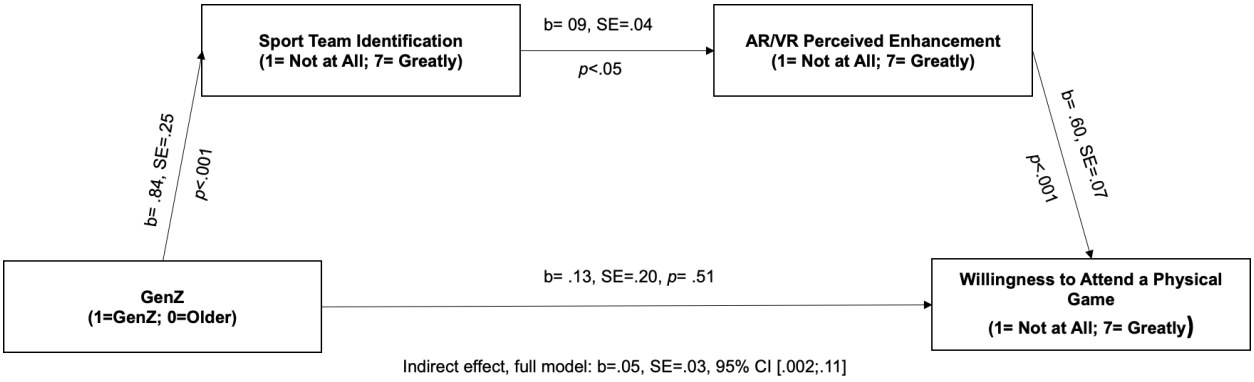
## SERIAL MEDIATION MODEL

To test the full conceptual model proposed in figure 1, I ran the data through Process Macro, Model 6 (Hayes, 2012) with Gen Z as the primary predictor, sports team identification as the first mediator, perceived AR/VR enhancement as the second mediator, and willingness to attend a physical game as the final outcome.

Consistent with the proposed conceptual model, the results revealed a significant effect of gen Z (vs. older generations) on sports team identification (b=.85, SE= .25, t(211) =3.32, p<.001). An increase in sports team identification then leads to a significant increase in perceived AR/VR enhancement (b=.10, SE= .04, t (211) =2.06, p=.04). This increase in perceived AR/VR enhancement then results in an increase in willingness to attend an AR/VR assisted physical game (b=.60, SE= .08, t(211) =7.82, p<.001).

More importantly, the results showed that there is a significant indirect effect of Gen Z on willingness to attend a physical game through sports team identification and perceived AR/VR enhancement (indirect effect = .05, SE= .03, 95%CI =[.002; .12]) through the bootstrapping procedure. There is, however, no direct effect of Gen Z on willingness to attend a physical (p>.05) suggesting that this is a full mediation mode (see Figure 5).

**FIGURE 5: SERIAL MEDIATION MODEL – PROCESS MACRO MODEL 6**




In summary, the results supported the research hypothesis and suggested that gen Z and the strength of sports team identification were important factors in the perceived enhancement of XR technologies in the sports industry. Generation Z was more likely to identify strongly with a sports team and therefore more likely to have increased perceived enhancement when using XR technologies and indirectly more willing to attend physical sports games. Older generations, characterized by Baby Boomers and Generation X, demonstrated lower levels of sports team identification compared to Generation Z individuals. Consequently, their perceived enhancement through XR experiences was also diminished. This indirect effect underscores the influence of generational differences in shaping attitudes and behaviors towards sports engagement, with

team identification and perceived enhancement serving as key mediators in driving willingness to attend physical games. Overall, understanding the interplay between these factors is crucial for optimizing fan experiences.

## DISCUSSION

This discussion provides a comprehensive analysis of the findings from the study on the impact of XR technologies on sports engagement, considering the alignment with the initial hypothesis and existing research in the field. The following section aims to elucidate the implications of the findings and highlight their significance in advancing knowledge in the domain.

The findings of the study are largely consistent with the initial hypothesis, which posited that Gen Z individuals with strong sports team identification would perceive greater enhancement through XR technologies compared to older generations. The data supported this hypothesis, revealing a significant positive relationship between Gen Z, sports team identification, and perceived enhancement with XR experiences. As older generations exhibited lower levels of perceived enhancement compared to Generation Z, this suggests that younger individuals, who are more accustomed to digital technologies and immersive experiences, perceive greater value and utility in the XR enhancements of sports. This further emphasizes the important of considering generational differences in technology adoption and preferences when designing and implementing XR initiatives within the sports industry. It also highlights the need for targeted strategies to cater to the diverse needs and expectations of different age cohorts,

ensuring the effectiveness and relevance of XR in enhancing the sports fan experience across generations.

These results are also consistent with previous research in several key areas as the positive association between sports team identification and enhanced XR experiences aligns with existing literature noted above in the introduction section which highlights the role of emotional attachment and fam in shaping fan engagement behaviors (Wann, 2006). Additionally, the indirect effect of enhanced XR experiences on willingness to attend physical sports games is consistent with prior findings that suggest immersive XR experiences not only enrich the digital sports experience, but also serve as a catalyst for offline engagement, driving attendance at live sports events among highlight identified fans (Cunningham et al., 2020).

The link between sports team identification and increased perceived enhancement through XR experiences is dependent on the strength and cultivation of an individual's sports team identification. While Generation Z individuals are generally more technologically savvy and inclined toward digital experiences, their receptiveness to AR/VR enhancements in the sports context is contingent upon their pre-existing level of sports team identification. The effectiveness of XR technologies in augmenting the sports experience is predicated on the foundation of a stronger emotional attachment to a sports team. For individuals belonging to Generation Z who lack prior sports team identification, the impact of AR/VR on enhancing the sports experience may be limited. Without a deep-seated allegiance or emotional investment in a particular team or sport, the immersive and interactive features of XR technologies may fail to resonate with these individuals. In such cases, the novelty and technological allure of XR experiences may not suffice to compensate for the absence of a genuine connection to the sports team. This emphasizes the importance of cultivating and nurturing sports team identification,

particularly among younger generations, as a prerequisite for maximizing the benefits of XR enhancements in sports. Sports organizations and marketers must focus not only on leveraging XR technologies to create engaging experiences but also on fostering a sense of belonging and loyalty among fans across all generations. By facilitating meaningful interactions and fostering emotional connections with the team, sports entities can enhance the receptiveness of Generation Z individuals to XR enhancements, thereby enriching the overall sports experience and driving long-term fan engagement.

The findings have important implications for both research and practice in the sports industry. The study highlights the need for further exploration into the interplay between generational differences in sports technologies to understand the mechanisms underlying fan engagement and behavior. From a practical standpoint, the findings emphasize the importance of integrating XR technologies strategically within sports marketing and engagement initiatives as sports organizations are seeking to enhance fan engagement and drive attendance at physical games. Sports organizations should prioritize the cultivation of sports team identification, particularly among younger fans, while also leveraging these XR technologies to create immersive and personalized fan experiences. Also, by creating targeted marketing efforts towards different generational cohorts, sports organization and marketers can tailor messaging and have experiences align with individuals' unique preferences and behaviors across all generations. By aligning XR features with fans' preferences and emotional connections to sports teams, organizations can foster deeper engagement, drive attendance at physical games, and enhance fans satisfaction and loyalty.

# MANAGERIAL IMPLICATIONS

The integration of AR and VR into the sports industry has ushered in a new era of fan engagement and immersive experiences. However, the implications of this technological shift extend beyond mere innovation, requiring sports organizations to navigate and re-imagine old strategies to appeal to the differences in generations. This section will explore the managerial implications of AR/VR in sports focusing on how these technologies affect different demographic groups, particularly Generation Z, and the strategies organizations must employ to leverage their potential effectively.

One of the key implications of AR/VR in the sports industry is the uneven impact it has on different generational groups in terms of sports behaviors and engagement. While Gen Z emerges as a pivotal demographic, exhibiting high receptivity towards AR and VR technologies and their integration into sports experiences, older generations may not demonstrate the same level of enthusiasm. As such, sports organizations must adopt a nuanced approach to marketing and advertising these technologies, recognizing that targeting older individuals may require alternative strategies in order to engage. This necessitates a careful balance in marketing strategies and budget allocation to ensure optimal utilization of resources while catering to the diverse preferences and behaviors of sports audiences across generations. Moreover, organizations must prioritize cultivating fan loyalty and identification, irrespective of age demographics, by leveraging AR/VR technologies as tools to enhance the overall fan experience and strengthen ties with teams and athletes. By cultivate a fans identity in its earlier stages, they are more likely to have memorable and engaging sports experiences and will continue to foster this later in life. It is important that organizations continue to study and learn how this bond is

formed as this is more important for getting fans into the sports while innovations and increased technologies like AR/VR are there to enhance the experience further for individuals who are already fans.

Effective management of AR/VR in the sports industry requires strategic planning and budget allocation to maximize the long-term growth and relevance of sports organizations. While these technologies hold immense potential for driving fan engagement and loyalty, their adoption may require time to reach maturity and widespread acceptance among different age groups. Thus, sports organizations must strike a balance in their investment strategies, ensuring that sufficient resources are allocated to the development and promotion of AR/VR initiatives without neglecting other essential areas of operation. This entails careful consideration of marketing budgets, with an emphasis on diversification and flexibility to adapt to evolving consumer preferences and technological advancements that are ongoing. By adopting a more strategic approach to budgeting and resource allocation, sports organizations can effectively harness the power of AR/VR to drive sustainable growth and competitiveness in the industry without falling behind in other areas.

The success of AR/VR initiatives in the sports industry hinges on the cultivation of fan identification and engagement across all demographic groups as the research found older generations tend to not have strong opinions regarding the use of AR/VR technology in sports viewing. While Gen Z represents a significant target demographic for AR/VR adoption, sports organizations must not overlook the importance of engaging older generations and fostering a sense of belonging and loyalty among all fans. This will require more initiatives into creative approaches that transcend technological novelty, encompassing diverse experiences and interactions that resonate with fans of all ages. By prioritizing inclusive and more immersive

sports experiences that cater to the interests of all generations, sports organizations can begin to create more memorable experiences for fans that lead to loyalty and increased engagement. This topic is important for organizations to continue researching further to navigate generational differences and drive long lasting growth.

## LIMITATIONS & FUTURE RESEARCH

This section will examine the outcomes of the survey investigating AR/VR engagement across generational groups, considering the inherent limitations of sampling, and proposing avenues for future research to mitigate their impact and dig deeper into this research topic. The utilization of convenience sampling in the survey inevitably led to sampling biases as discussed in the methodology section above, limiting the generalizability. The sample skews towards a mostly female audience making the results less representative of a male audience, which is historically the most dominant sports viewing demographic. However, the results still produced a positive effect of sports fan identification and AR/VR receptibility, regardless of it being a mostly female sample. In future research, the survey would ensure more strict testing requirements to ensure more diverse sampling recruitment methods and gender inclusivity. It could also examine the underlying factors contributing to gender disparities and how AR/VR effects genders differently to tailor marketing and engagement strategies to appeal to a broader audience. Another limitation that was encountered in the survey was what is known as the snowballing effect, whereby participants recruited others from their own social networks, potentially reinforcing existing demographic patterns within the sample. This phenomenon

exacerbates sampling biases and limits the diversity of perspectives represented in the data. Future research endeavors could explore more innovative and representative recruitment strategies to enhance diversity and minimize any biases. In addition, time constraints posed challenges in conducting comprehensive research since it was completed over the course of only two months. Future research could explore longitudinal studies to track changes in AR/VR adoption and engagement over time, allowing for a more nuanced understanding of generational trends and preferences as well as having the opportunity to gather more survey participants and perform the study in a strict testing environment.

This survey and results were just the first set in a much longer story that has the potential to be researched. In the future, it will be important to investigate the impact of immersive technologies on sports consumption behaviors and fan experiences as the landscape of sports entertainment continues to evolve and gain more traction. More in depth studies should be done to continue testing the relationship between AR/VR engagement and fan loyalty, as well as its influence on sports teams' identification and how to develop it further. This could shed light on the mechanisms through which immersive technologies contribute to enhancing the emotional connection between fans and their favorite teams. It would also be impactful to explore innovative applications of XR technologies beyond traditional viewing experiences, such as fan interactions, virtual merchandise, and gamification elements, which could uncover new opportunities for enhancing fan engagement and driving revenue generation while also exploring which ones nowadays have the most impact. Lastly, exploring the role of social networks, peer influence, and social norms in shaping individuals' attitudes and behaviors towards XR technologies in the context of sports could offer valuable insights into the mechanisms driving technology across generations as Gen Z is more technologically versed.

While there are many positive impacts of technological adoption on fan loyalty and engagement, it is important to also acknowledge the potential resistance from some fans. Although technology can enhance the experience for some fans, others may long for a more traditional and unaltered sports experience so it's best to understand where to draw the line between continued innovation and growth while also seeking fan satisfaction (Johnson and Brown, 2018). Ethical considerations need to also be considered when it comes to Ai being used to impact real humans and their decisions. Since large amounts of data are constantly being collected it is also important to ensure that it is being used ethically to protect personal information and made secure (Grandinetti, 2019). Although technology is increasingly becoming more popular it is important to remember that not every organization or team will have equal access to this advanced equipment and data which might create disparities and unfair advantages so maintaining a level playing field is also an important ethical challenge.

By addressing these limitations and embracing innovative research approaches, scholars and sports organizations can contribute to a more robust understanding of XR engagement across diverse generational groups and drive meaningful advancements in the sports industry. It will help to deepen the understanding of the complex dynamics between technology, sports fandom, and generational trends, ultimately guiding the development of innovative strategies to enhance fan experiences and longer lasting growth of the sports industry

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# APPENDIX

## Survey: AR/VR in the Sports Industry

Consent form

**Informed Consent to Participate in Research**

**Overview:** You are invited to participate in a research study. In order to participate, you must be between the ages of 18 – 65.

This study is being conducted online via Qualtrics survey designed at Texas Christian University and is conducted by Ashton Mueller (Honors student, Marketing, Texas Christian University). This research is supported/sponsored by Dr. Chi Tran (Assistant Professor in Marketing, Neeley School of Business, Texas Christian University). The purpose of this study is to determine the impact that social media and technology have had in recent years on the engagement levels of the sports industry. The research includes a brief 10 minute online survey in which you will answer questions relating to this research topic.

**Participants:** You are being asked to take part because we are looking at results across various age groups and you fall between 18 and 65 years old. We want to see the level of exposure and impact across age groups. If you decide to be in this study, you will be one of 300 participants in this research study at TCU. Voluntary Participation: Your participation is voluntary. You do not have to participate and may stop your participation at any time.

**Confidentiality:** Even if we publish the findings from this study, we will keep your information private and confidential. Anyone with authority to look at your records must keep them confidential.

**What is the purpose of the research?** The purpose of this study is to test whether social media and advanced technology have had a positive or negative impact on engagement levels across sports organizations.

**What are the risks for participating in this study and how will they be minimized?** We don't believe there are any risks from participating in this research that are different from risk that you encounter in everyday life. What is my involvement for participating in this study? Participants, after receiving an email, will click the link which will take them to the Qualtrics survey. Participants will answer a few questions relating to this study which should take about 10 minutes. They will end by entering in demographic information to ensure they are within the qualifying age group. After finishing, participants will close out of the survey and are done.

**Are there any alternatives and can I withdraw?** You do not have to participate in this research study and are free to withdraw at any time before submitting by exiting out of the

survey. You should only take part in this study if you want to volunteer. You should not feel that there is any pressure to take part in this study.

**What are the benefits of participating in this study?** You might benefit from being in this study because you will gain more understanding of sports entertainment and engagement.

**Will I be compensated for participating in this study?** No compensation will be provided. However, at the end of the survey you have the opportunity to provide your email address for a chance to be randomly chosen for a $25 gift card.

**What are my costs to participate in the study?** You will not incur any costs during this research study.

**How will my confidentiality be protected?** Every effort will be made to limit the use and disclosure of your personal information, including research study records, to people who have a need to review this information. We cannot promise complete secrecy. Your records may be reviewed by authorized University personnel or other individuals who will be bound by the same provisions of confidentiality. We may publish what we learn from this study. If we do, we will not include your name. We will not publish anything that would let people know who you are.

**What will happen to the information collected about me after the study is over?** We will not keep your research data to use for future research or other purposes. Your name and other information that can directly identify you will be deleted from the research data collected as part of the project. We will not share your research data with other investigators.

Who should I contact if I have questions regarding the study or concerns regarding my rights as a study participant? You can contact Ashton Mueller at ashton.mueller@tcu.edu or Dr. Chi Tran at p.chi.tran@tcu.edu with any questions that you have about the study. Dr. Brie Diamond, Chair, TCU Institutional Review Board, (817) 257-6152, b.diamond@tcu.edu; or Dr. Floyd Wormley, Associate Provost of Research, research@tcu.edu. For more information please visit our website https://research.tcu.edu/research-compliance/irb/for-research-participants/.

By selecting "Agree to participate" below, you are agreeing to be in this study. Make sure you understand what the study is about before you agree. You will be given a copy of this document for your records upon request. If you have any questions about the study after you agree to participate, you can contact the study team using the information provided above.

Consent Agree to Participate

◯ Yes (9)

Gift_Card Provide your email address below if you would you like to be entered into the randomized raffle for a chance to win a $25 gift card (Please type NA if you do not).

_____

End of Block: Default Question Block

---

Start of Block: Transition 1

transition1 The following set of questions ask you for your opinion regarding AR (Augmented Reality) / VR (Virtual Reality) Technologies. Please answer to the best of your knowledge.

**For the purpose of this study:**

AR refers to an immersive technology that overlays digital information such as images, text, or sounds onto a user's real-world environment via smartphone, tablet, or glasses.

VR involved the creation of a completely immersive computer generated environment that user's are able to interact within to create an artificial environment via headset or other simulation device.

Here we are interested in AR/VR technologies in general.

End of Block: Transition 1

---

Start of Block: VR/AR familiarity

fami How familiar are you with AR/VR?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Not familiar at all | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | Highly familiar |

past Which of the following best describes your experience with AR/VR Technologies?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| No experience at all | ○ | ○ | ○ | ○ | ○ | ○ | ○ | A lot of experience |

End of Block: VR/AR familiarity

Start of Block: AR/VR Attitudes & Sports Engagement

transition2 In the following questions, we will focus exclusively on AR/VR experience within the **sports entertainment industry.**

sport_location Where do you most often watch sporting events? (Please select all that apply)

- ☐ In Stadium (1)
- ☐ Live Streaming at Home/Social Event (2)
- ☐ Streaming Post Game at Home/Social Event (3)
- ☐ Virtually via Smartphone or other device (4)
- ☐ I don't watch Sports Events (5)
- ☐ Other (6)

Page Break

transition3_examples In the past few years, sports teams and organizations have incorporated aspects of AR & VR into their fans' sports experience, **below are a few examples:**

Note that this page will hold for at least 20 seconds. Please review the examples carefully.

example_familarity Have you noticed/seen any of these examples (or something similar) in the past?

- ○ Yes (1)
- ○ No (2)

*Display This Question:*

*If Have you noticed/seen any of these examples (or something similar) in the past? = Yes*

occas Which of these examples (or others you have seen) have heightened your viewing experience the most?

_____

Q34 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

engage What changes (if any) have you noticed in your **sports consumption engagement** since the introduction of new technologies - AR & VR?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Decreased significantly | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Increased significantly |

enhance To what extent do you believe that AR and VR can enhance the sports viewing experience?

| | 4 (1) | 5 (2) | 6 (3) | 7 (4) | 8 (5) | 9 (6) | 10 (7) | |
|---|---|---|---|---|---|---|---|---|
| Not at all | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Significantly |

X→

attend Would you be more likely to attend a live sports event if it offered interactive AR & VR experiences?

| | 11 (1) | 12 (2) | 13 (3) | 14 (4) | 15 (5) | 16 (6) | 17 (7) | |
|---|---|---|---|---|---|---|---|---|
| Extremely unlikely | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Extremely Likely |

Page Break

Overlays AR/VR Overlays can add extra context about the games and competition, improve the accuracy of referees, and give fans new ways to interact with their teams.

To what extent do you believe that AR/VR Technology (such as the ones previously displayed) would enhance your overall engagement in the sporting event?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Negatively impact my engagement | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Positively impact my engagement |

which_features What features of AR & VR would be most engaging to you? (Please select all that apply)

- ☐ Video Assistant Referee (VAR) to improve accuracy of line calls (1)
- ☐ Live player statistics such as speed and probability odds (2)
- ☐ Player Biometrics such as physical and behavioral characteristics (3)
- ☐ Interactive VR mobile smartphone games (4)
- ☐ AR overlays that provide game context and trending game specific social media content (5)
- ☐ Interactive Stadium Experiences such as virtual tours, behind the scenes, concession wait times, etc. (8)
- ☐ Virtual Merchandise to try on gear (9)
- ☐ None (6)
- ☐ Other (please specify) (7) _____

unable How likely would you be willing to utilize AR or VR technology to watch a sporting event if it were physically inaccessible (e.g. due to distant location, cost of entry, weather, etc.?)

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Extremely unlikely | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Extremely likely |

cost Would you be willing to pay extra for an AR/VR sports experience?

- ○ No (5)
- ○ Yes (6)

End of Block: AR/VR Attitudes & Sports Engagement

Start of Block: AR/VR Feelings

scon If you follow sports organizations, players, or team related content - to what extent do you believe AR and VR technologies have impacted the way you connect with a sport?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Extremely negative | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Extremely positive |

econ In your opinion, how does the use of AR & VR in sports affect your emotional connection to the game or event?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Weakens my connection | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Strengthens my connection |

comm To what extent do you think AR/VR contributes to building a sense of community among sports fans?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Not at all | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Extremely likely |

fans Has engaging with sports through AR/VR affected your social interactions with other sports fans positively or negatively?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Negatively affected | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Positively affected |

End of Block: AR/VR Feelings

Start of Block: Technology/Sports Behavior

often How often do you watch and engage with sports content on social media such as behind the scenes views, exclusive interviews, teams and players social media accounts, etc. ?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Not at all | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Always |

X→

identity How much do you think that your favorite sports organizations and players reflect your personal identity?

| | 1 (1) | 4 (2) | 5 (3) | 6 (4) | 7 (5) | 8 (6) | 9 (7) | |
|---|---|---|---|---|---|---|---|---|
| Not at all | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Greatly |

future Would you be interested in using more advanced AR/VR technologies to enhance your sports viewing experience in the future?

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | 7 (7) | |
|---|---|---|---|---|---|---|---|---|
| Extremely uninterested | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Extremely interested |

which_sports Which sports would you most like to see incorporate AR & VR into their sport events?

- ☐ Soccer (MLS) (1)
- ☐ Football (NFL) (2)
- ☐ Basketball (NBA) (3)
- ☐ College football (NCAA) (4)
- ☐ College basketball (NCAA) (5)
- ☐ Tennis (6)
- ☐ Golf (PGA or LPGA) (7)
- ☐ Baseball (MLB) (8)
- ☐ F1 Racing or NASCAR (9)
- ☐ Hockey (NHL) (10)
- ☐ Other (please specify) (11) _____

Attn check Attention Check: Please select *Strongly disagree* for this question.

- ○ Strongly disagree (1)
- ○ Somewhat disagree (0)
- ○ Neither agree nor disagree (0)
- ○ Somewhat agree (0)
- ○ Strongly agree (0)

**End of Block: Technology/Sports Behavior**

Start of Block: Demographics

Age How old are you? Please type a whole number

_____

Gender How do you describe yourself?

- Male (1)
- Female (2)
- Non-binary / third gender (3)
- Prefer to self-describe (4) _____
- Prefer not to say (5)

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Income What was your total household income before taxes during the past 12 months?

- Less than $25,000 (1)
- $25,000-$49,999 (2)
- $50,000-$74,999 (3)
- $75,000-$99,999 (4)
- $100,000-$149,999 (5)
- $150,000 or more (6)
- Prefer not to say (7)