"Culinary Dimensions: Discovering Himachali Flavours with Augmented Reality"

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ABSTRACT

In recent years, Augmented Reality (AR) has become powerful digital platform for education and marketing allowing brands to offer interactive, memorable experiences that engage customers in new and innovative ways. This paper explores to study Augmented Reality expsseriences for teaching Himachali cuisine reflecting cultural and culinary heritage amongst the locals and visitors combining AR technology with traditional culinary education. The research has been conducted using quantitative approach for tourists through an online questionnaire and qualitative approach for the stakeholders. Likert-scale was applied to assess their satisfaction, engagement and willingness to recommend the experience with the results analysed by Chi-Square test and t-Test in SPSS software. The results show that there is positive association between familiarity with AR and interest in AR-based culinary experiences. Additionally, the strong interest has shown by frequent travellers in AR-based culinary experiences. Thus, this paper examines the potential and beneficial effects of AR promoting food heritage tourism through virtual culinary experiences that may increase knowledge about local gastronomy among locals and visitors as well. Focusing on the current practices and modern AR technologies, the main issues relating to culinary learning and challenges faced in their implementation worldwide have been highlighted along with the future potential of AR in the preservation and promotion of regional food heritage.

Keywords: Himachali-cuisine; Augmented Reality (AR); food-tourism; promotion.

INTRODUCTION

Himachal Pradesh, a state located in the Northern region of India, has rich cultural heritage based, influenced by its geography and history. Himachali dishes like "Chana Madra", "Dham", and Siddu' known for its use of locally sourced ingredients, distinct flavour, and traditional cooking methods have character of Himachali food culture (Sharma, 2019).

In the present digital age, the use of innovative technologies like Augmented Reality (AR) can rejuvenate interest in regional cuisines. AR brings to real world experiences merged with digital information which has the potential to enhance tourists' curiosity and engagement. Through interactive cooking guides, virtual storytelling, and gamification, AR can create unique experiences that appeal to tech-savvy tourists seeking authentic cultural interactions (Buhalis & Sinarta, 2019).

In recent years, many countries have been integrating AR technology in their culinary education and tourism as well. For instance, AR applications are used for teaching locals and tourists in Japan on how to cook traditional dishes such as Sushi or Ramen which becomes a cultural learning experience (Xue, 2023). In Spain as well, AR has been applied in gastronomic tours such that tourists can be guided by renowned chefs virtually and learn the secrets of Spanish culinary like Tapas & Paella.

AR can be used for replication of kitchen environments in culinary education to guide learners' step by step. An AR application guiding users on how they could make "Siddu", visualizing every state and action required during

preparing like chopping vegetables or measuring spices (Rahman et al. 2020).

There is not any AR apps specifically dedicated to Himachali cuisine as of now, several general AR platforms and apps can be leveraged by the restaurants and local eateries to highlight and promote Himachali cuisine. Thus, this culinary heritage is under threat as more of the younger generation, is attracted to fast food and quick meal solutions, without necessarily knowing their post-affects, is leading to decline in the traditional cooking methods. This paper identifies the significance that AR technology could play in ensuring Himachali cuisine remains a living tradition by teaching new generation of learners.

LITERATURE REVIEW

Himachali cuisine use minimal spices, allowing natural flavours of its gradients to shine through. The staple diet includes pulses, lentils, rice etc with yogurt and home-grown fresh vegetables. Dham (a traditional Himachali cuisine) is served in a specific order one after another following symbolising balance of taste, nutrition and spirituality" and is made up of Madra, Kadi, Meetha Bhaat, and Aloo Palda, illustrates the deeply rooted culture on Himachali society (Sharma, 2019). Babru, Tudkiya Bhat are also appreciated for their essence. Traditional Himachali food practices are continuously passed down through the generations, are vital for maintaining the cultural continuity (Sharma & Verma, 2020). But with the inevitable changes ushered in by modernization, and migration, such an ancient system of learning is at risk if not documented for posterity (Verma, 2018).

Interactive Learning through Augmented Reality in Gastronomy

Augmented Reality (AR) apps superimpose digital content on the physical world giving a mixed-reality experience where users can interact with both physical and virtual elements. The key components of AR include cameras, sensors, processors and display which work together to combine digital images with real-world environments (Azuma 1997). Modern technology such as smart phones and wearable devices have made AR more easily available to the general public, including mobile apps from Apple, making it an important tool for numerous applications e.g. education (Chen et al., 2020). AR is a digital tool, offers an interactive platform that can be used to showcase regional cuisines in a visually engaged manner by providing immersive storytelling and interesting elements (Chung et al. 2021).

AR is stepping into gastronomy too, involving in the creation of enhancing dining and food tourism. AR dining experiences, where the eaters can get the picture of ingredients and the preparation process of their meal in real-time, have become increasingly popular in high-end restaurants (Smith & Lee, 2022). These have been successful, implemented to generate engagement with diners and bringing something new into the gastronomy scene.

Food tourism, where tourists explore local cuisine and culinary practices, has become a key component of cultural tourism worldwide. Augmented Reality provides a unique opportunity to engage tourists by offering virtual cooking tutorials, interactive dining menus and culinary tours (Thomson & Brown, 2022).

Kapoor (2020) writes that in Japan and Spain, AR has been utilized to upgrade cultural tourism alongside gastronomy which can provide virtual cooking classes for tourists who are interested in culture with a new level of insight-learning experience based on food.

By giving real-time feedback and virtual instructions, AR assists in learning process by making it more engaging and interactive. A study conducted by Squire & Jan (2021) revealed that this is particularly relevant in culinary education, where replication of traditional techniques and precise measurements is crucial for success.

Some Best Practices with Common Uses of AR in Learning

There are now many AR applications teaching to cook better and more effectively. Popular cases are:

"Chef AR" apps which let the user choose a recipe and then see step-by-step instructions, directly mapped in their kitchen from projecting through his Smartphone or wearable AR glasses/ device. For instance, in the preparation of 'Siddu', as one kneads dough and prepares a blend consisting nuts or lentils followed by steaming for specific duration to finally achieve the right texture. AR capabilities provide the opportunity for learners to see every stage illustrated, get instant feedback on their method and even simulate how a final dish would be presented. Immersing individuals in a virtual kitchen environment, AR allows learners to conveniently practice without the need for an actual space and equipment making cooking classes available even those who are not able to afford traditional ones (Rahman et al., 2020).

Another example is **"AR Cooking Guide,"** which not only provides recipes but also includes lessons behind the cultural history and significance of every dish.

Challenges in Introducing AR to Culinary Education

Technological Barriers

a). **Infrastructure:** AR carries immense potential in transforming culinary education but there are many challenges to its implementation as well. And one of the biggest hurdles is in what kind of technological infrastructure we need to have for supporting AR apps. High quality AR experiences depend on advanced hardware, including smart phones with high processing power, cameras, and AR enabled devices like smart glasses (Azuma in 1997). Himachal Pradesh state has very limited access to such technology; the adoption of AR in educational and tourism contexts may be very slow.

b). **Cost, Scalability and Content:** The absolute price of creating and delivering AR culinary education tools would also be a considerable challenge. However, this solution may not be viable for small-scale institutions or individual learners as it can get quite expensive to create AR content and purchase the hardware required. Resource availability (particular in rural regions where technology is sparse), too, may pose a limitation on the scalability of AR platforms (Kapoor, 2020).

The AR content material may be costly, and requires expertise in both technology and subject matter. For Himachali Cuisine, this could be working with chefs, cultural historians, and technologists to produce real-life accurate content in collaboration that truly reflects the culinary traditions (Smith & Lee, 2022).

With the sustained growth of AR technology, it is expected that these costs will decrease, making it more accessible to a wider audience. Nevertheless, in short term, the challenge of affordability remains a key concern for the widespread adoption of AR in culinary education.

Culture Preservation V/S. Technology

However, AR does carry with it the challenge of diminishing or complicating traditional values in cooking as well. Even with AR that simulates cooking processes, it may not fully convey modulations of certain techniques that rely on sensory input, such as feel (dough) or smell (spice on a hot pan). An example being that learners may rely too much on digital instructions instead of situational advices and culturally implied knowledge **(Squire & Jan, 2021)**.

AR applications can alleviate this by designing them to supplement, rather than replace, traditional culinary education skills. Combined learning approaches, where AR can be used alongside in-person instruction, may offer a more balanced solution that preserves the authenticity of Himachali cuisine while incorporating modern technology (Thomas & Brown, 2022).

Ar In Culinary Education and Innovations

AR Technology: AR technology is continuously evolving to bring new features and innovations in the culinary education industry. The future AR platforms might use artificial intelligence (AI) to allow for more customized learning experiences. For instance, an AI could scrutinize if the cooking method of a user was perfect enough or not and then provide personalized feedback for improvement (Chen et al., 2020).

What's more, AR might be converged with other disruptive technologies such as virtual reality (VR) and haptic feedback to deliver an even richer learning experience. For example, with haptic technology, users could sense the texture of the ingredients or feel the physical resistance of dough while kneading in AR culinary education (Xue, 2023).

Collaborative Learning Platforms

AR can probably even create global collaborative learning platforms for cooking education. AR apps would allow chefs, home cooks and food lovers from around the world to connect and share their recipes, culinary techniques or insights into cultural cooking styles. This would not only foster cross-cultural exchange but also help preserve and promote regional cuisines link Himachali food on a global scale **(Verma, 2022)**.

Protection of Indigenous Knowledge

AR can be used as a tool to document and digitize traditional Himachali recipes, techniques and cultural practices. AR technology can also be used to reach the next generations possibly not interested in learning traditional cooking methods, could be re-engaged through the use of interactive and immersive technology **(Sharma & Verma, 2020)**.

Objectives

- To assess AR as both an educational tool and a tourism marketing activity for promoting Himachali cuisine.
- To explore the use of AR in creating virtual culinary experiences for tourists.
- To highlight the challenges in integrating AR into traditional culinary education.
- To provide recommendations for leveraging AR to attract tech-savvy tourists after interviewing the focussed stakeholders.

RESEARCH METHODOLOGY

The research has utilized both qualitative and quantitative methods to explore the potential of AR in promoting Himachali cuisine. An online survey of 30 tourists, who visited Himachal Pradesh, was conducted. The non-probability (convenience) sampling method was used to reach respondents. A structured questionnaire based on demographics, knowledge of AR technology, interest in AR-based culinary experiences, and perceived challenges related to the adoption of AR technology in Himachal Pradesh. Qualitative analysis has been done by interviewing different types of stakeholders and using researchers' personal judgement.

Data Analysis

The survey data collected was analysed using SPSS software. The following statistical tests were conducted:

a. **Descriptive statistics** to examine demographic characteristics, frequency of travel, and experience with AR.

b. **Chai-Square Tests or Cross-tabulations** to determine the association between two categorical variables such as familiarity with AR and interest in AR features.

c. **Independent Samples t-Test** to compare the demographic groups (age, travel frequency) on satisfaction with Himachali cuisine experience, likelihood of using AR between respondents aware and unaware of the technology.

Four key Hypotheses were tested:

i. There is no significant difference between familiarity with AR technology and interest in AR features related to Himachali cuisine.

ii. There is no significant association between the frequency of travel and interest in AR-based virtual culinary experiences.

iii. There is no significant difference in perception of AR challenges (such as cost, awareness) based on prior experience with Himachali cuisine.

iv. There is no significant difference in the likelihood to revisit Himachal Pradesh based on familiarity with AR technology.

RESULTS AND INTERPRETATION

Demographics: The majority (51.6%) of respondents were aged between 26-35 years and from diverse backgrounds. Gender distribution was nearly balanced (51.6% male, 45.2% female). 74.2% respondents were domestic tourists while 25.8% were international tourists. From analysis, it is found that younger generation is more likely receptive to digital technology like AR, making them an ideal target audience for AR-based culinary tourism.

Hypothesis Testing and Results

Hypothesis 1: Familiarity with AR and Interest in AR characteristics:

a. **Chi-Square Test Result**: Pearson Chi-Square = 1.892, $p = 0.595$ ($p > 0.05$)

b. **Conclusion:** Familiarity with AR does not influence the interest of tourists in AR characteristics. Both those familiar and unfamiliar with AR expressed their excitement and curiosity for AR-based experiences.

Hypothesis 2: Travel Frequency and Interest in AR-based Experiences:

a. **Chi-Square Test Result**: Pearson Chi-Square = 3.547, $p = 0.965$ ($p > 0.05$)

b. **Conclusion:** Travel frequency does not affect tourists' willingness to explore AR-based culinary experiences. This suggests that AR can attract a wide range of tourists, regardless of how often they travel.

Hypothesis 3: Perceptions of AR Challenges Based on Experience with Himachali cuisine:

a. **t-Test Result**: $t = 0.977$, $p = 0.337$ ($p > 0.05$).

b. **Conclusion:** There is no significant difference in perceptions of AR-challenges between those who have experienced Himachali cuisine and those who have not. So,this indicates that challenges like price and awareness are universal concerns among tourists.

Hypothesis 4: Likelihood to Use AR Based on Familiarity

a. **t-Test Result**: $t = 2.366$, $p = 0.025$ ($p < 0.05$).

b. **Conclusion:** The tourists familiar with AR are more likely to use it for exploring Himachali cuisine. Promoting AR literacy could boost engagement and encourage tourists to visit again.

Qualitative Methods for Study

In the present study, the qualitative approach, which consists of interviews and discussions with the focused groups of different stakeholders, has also been adopted. These have provided invaluable insights. These discussions have revealed their personal experiences and observations of AR-based culinary learning, and shed light on its potential benefits and challenges. The essentials of the interviews are illustrated hereunder:

a) Engaging Local Chefs, Culinary, and Experts

Local chefs, and culinary, and cultural experts revealed the importance of authenticity of Himachali cuisine. Many of them stressed that traditional cooking methods and recipes need to be preserved to maintain the ancient culinary culture. The local chefs and cooking experts also drew attention to ingredients sourced from the local areas, which are essential for creating authentic Himachali dishes. They possess a very good knowledge that is crucial for connecting AR innovations with culinary authenticity. Their perceptions can guide the development of AR tools that admire and celebrate traditional cooking techniques and cultural heritage, ensuring that technology serves as a complement rather than a replacement.

b) Collaborative Learning Segments

The Chefs also stressed the need for culinary education for young aspiring cooks to understand the rich history of Himachali dishes. They also emphasized the need to collaborate with hospitality schools and educational institutes to teach students about the ingredients, cooking methods, and cultural significance of each dish. Creating collaborative learning segments can further strengthen the aim of educating people about Himachali cuisine. These segments need to include tutorials, quizzes, and learning experiences through games to make the AR application more enjoyable and engaging. Simultaneously, the participation can be incentivized to attract a large number of visitors and food lovers, including younger generations who are less familiar with traditional cooking methods.

c) Virtual Food Tours

AR technology can also be applied for the development of guided virtual food tours, which can take users through local markets, hotels, restaurants, local haats, and farms, combining immersive experiences with educational knowledge about the local ingredients, preparation methods, and cultural stories. These experiences support a greater appreciation for local culinary traditions while attracting visitors seeking authentic cultural experiences.

d) Balancing Tradition and Innovation:

Some chefs gave thrust to value traditions, while others were open to innovation. They believe in introducing modern cooking techniques while respecting traditional flavours that can enhance the overall culinary experience. For example, some chefs revealed to have utilized fashionable silver and golden plating styles more appealingly to present traditional dishes without changing their original flavours.

e) Affordability of AR Technology

It is essential to address the affordability of AR technology because it presents promising opportunities for culinary explorations. AR applications will capitalize on their reach and accessibility, provided these are user-friendly, and cost-effective.

f) Easy Internet Access in Remote Areas

Still, there are many parts of Himachal Pradesh that have poor access to the internet, posing challenges for the implementation of AR technology. Collaborating with the technology companies and local governments to develop infrastructure could further facilitate maximum adoption of AR technology in culinary tourism. Offline options or low-bandwidth alternatives could also be explored to enhance the AR experiences in remote areas.

g) Storytelling Through Himachali Dishes

The diverse views of chefs and the storytelling behind Himachali dishes provided a rich knowledge of Himachali culture. Each dish comes with a particular narration that reflects the region's customs, agricultural practices, and community values, ensuring that Himachali cuisine remains an important part of the local identity. For example, Dham is a ceremonial meal that is often prepared during marriages and festivals, Siddu is a dish associated with lifelong traditions, typically made during special gatherings and celebrations. The trout is locally sourced in the Beas River and its tributaries in the Kullu district, generally fried or grilled, being a special boneless fish which is deeply entwined with the region's rivers and streams. The chefs also explained that traditions and modernity should go hand-in-hand to preserve the culinary heritage of Himachal Pradesh and inspire future generations to explore and celebrate their roots.

DISCUSSION

The findings reveal that there is considerable interest and enthusiasm in using AR for culinary tourism familiarity with AR. However, tourists who are already acquainted with AR are more likely continue to hold it for food-related experiences. Thus, increasing AR awareness campaigns marketing activity. This study also suggests that both frequent and occasional tourists are open to adopt AR. The successful integration is possible by overcoming challenges of high cost of AR implementation and limited awareness. AR technology can be more accessible to budding chefs and culinary enthusiasts alike, with the active collaboration between local businesses and organizations which contribute to shared resources.

The qualitative findings highlight a delicate balance between tradition and modern technology when it comes to showcasing Himachali cuisine through AR. The local chefs and culinary experts stress the need to preserve authenticity along with utilizing AR for education, engagement, and tourism. Virtual food tours bring cultural stories to life, and partnerships with hospitality schools can promote awareness about the region's rich culinary heritage. However, challenges like affordability and limited internet access in remote areas need to be addressed. AR integrated with traditional cooking practices creates immersive experiences that commemorate Himachali heritage, ensuring its continuity for future generations and appealing to global food lovers.

Limitations

There were only 30 tourists in the study sample. A few personal interviews with local chefs, cooking experts, and cultural experts have been conducted. More heterogeneous and culturally diverse sample of local participants could have provided more information, details of issues and their valuable opinions. At the same time, more tourists in the diverse areas of the region might have provided additional experiences, goals and design implications. Accordingly, the observations could not be generalized to a wider area of Himachal Pradesh.

RECOMMENDATIONS

a. **AR awareness campaign:** Organize online campaigns and workshops to introduce tourists to AR technology, and its use.

b. **Advantage of social media:** Showcase Himachali culinary experiences on Face book, Instagram and YouTube by enhancing AR elements.

c. **AR-application designing:** AR application providing interactive recipe guides, enabling users to learn about the traditional dishes, offers virtual cooking tutorials and cultural narratives & insights into Himachali dishes. It should use geolocation to recommend local eateries and markets.

d. **Teamwork with Local related Businesses:** Associate with restaurants and cultural centres to integrate AR features into dining and educational experiences as well.

CONCLUSION

Augmented Reality has the potential to transform food tourism by preserving Himachali traditional culinary practices and promote tourists' experiences. AR makes traditional dishes more accessible, enriches learning and promotes cultural understanding overcoming geographical boundaries.

Even the inherent challenges associated with technological infrastructure, cost, and maintaining authenticity, AR

offers great potential for the future. It simulates complex cooking methods, provides instant virtual view and enhances cultural experiences. Moreover, in food tourism, AR can attract tourists to Himachal Pradesh by offering virtual preview of local cuisine.

As AR technology evolves with the integration of artificial intelligence, virtual reality and haptic feedback to culinary education could undergo a transformative change from international cooking classes to preserving endangered cultural cuisines in the digital format. AR makes the food experience more accessible and cost-effective. AR has the potential to elevate regional cuisines like Himachali to a global reach.

In this new era of digital transformation learning and AR which acts as a bridge between our past and future will make sure Himachali culinary traditions are alive and relevant for the future generations.

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