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Augmented Reality in culinary education: Didactic innovation for learning culinary cuts

Realidade Aumentada no Ensino da Culinária: Inovação Didática para o Aprendizado de Cortes Gastronômicos

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Resumen

Este artículo evaluó la percepción de la aplicación de la Realidad Aumentada (RA) como herramienta didáctica en la Licenciatura en Gastronomía de la Universidad Autónoma del Estado de Hidalgo (UAEH). Se empleó el método de investigación-acción, que involucró a 17 docentes y 113 alumnos de primer semestre, los cuales se dividieron en un grupo de validación de instrumentos de recolección de datos, un grupo de control y un grupo experimental. Se utilizó la aplicación (app) *CulinaryVision* para facilitar la visualización e interacción con modelos tridimensionales de vegetales y hortalizas, lo cual facilitó a los estudiantes comprender mejor los cortes regulares e irregulares. Los resultados mostraron que el 78.8% de los alumnos del grupo experimental consideró que la app mejoró la comprensión de las técnicas profesionales de corte de vegetales, mientras que en el grupo de control, el 93.3% afirmó que la app hubiera sido de gran ayuda. Además, el 70.6% de los docentes manifestó interés en incorporar RA en sus clases.

Palabras clave: Realidad aumentada, percepción, gastronomía, tecnología educativa.

Abstract

This article evaluated the perception of augmented reality (AR) implementation as a teaching tool in the bachelor's degree in gastronomy at Universidad Autónoma del Estado de Hidalgo (UAEH). An action research method was used, involving 17 instructors and 113 first-semester students, divided into an instrument validation group, a control group, and an experimental group. CulinaryVision was used to facilitate three-dimensional visualization and interaction with vegetables, which makes it easier understanding regular and irregular cuts. The results show that 78.8% of students in the experimental group considered that the application improved understanding of profesional vegetables cutting techniques, while in the control group, 93.3% stated that the application would have been very helpful. Furthermore, 70.6% of instructors expressed interest in incorporating AR into their clases.

Keywords: Augmented reality, perception, gastronomy, educational technology.

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Resumo

Este artigo avaliou a percepção da Realidade Aumentada (RA) como ferramenta de ensino no curso de Bacharelado em Gastronomia da Universidade Autônoma do Estado de Hidalgo (UAEH). Foi utilizada a metodologia de pesquisa-ação, envolvendo 17 professores e 113 alunos do primeiro semestre, divididos em um grupo de validação do instrumento de coleta de dados, um grupo de controle e um grupo experimental. O aplicativo CulinaryVision foi utilizado para facilitar a visualização e a interação com modelos tridimensionais de vegetais, auxiliando os alunos a compreender melhor os cortes regulares e irregulares. Os resultados mostraram que 78,8% dos alunos do grupo experimental consideraram que o aplicativo melhorou sua compreensão das técnicas profissionais de corte de vegetais, enquanto no grupo de controle, 93,3% afirmaram que o aplicativo teria sido muito útil. Além disso, 70,6% dos professores manifestaram interesse em incorporar a RA em suas aulas.

Palavras-chave: Realidade aumentada, percepção, gastronomia, tecnologia educacional.

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Introduction

Professionalization The culinary arts arise from the need for cooks to adapt to the constant change in eating habits in each region and country . This is due, in part, to the expansion of restaurants and the increase in demand from diners . Galarza et al. (2023) they explain In the restaurant industry, it is necessary to have cooks and chefs who, in addition to having technical culinary skills,

Having adequate knowledge and skills in restaurant management and administration is essential to address any challenge that arises in this industry , such as calculating recipe costs, menu renewal , and management. operation of the establishments .

Currently, the need for professionals with practical and administrative knowledge in the food and beverage sector remains constant, and as Garzón et al. (2024) mention, during the teaching process of the practical part of this profession, it is necessary to implement specific controls in food handling since the handling of perishable products is implicit , and if not used properly, it implies a loss of supplies, which produces an economic loss .

Augmented reality and gastronomy

With technological advancements, the implications of handling perishable products in the field of culinary education can be addressed by introducing didactic tools into theoretical and practical classes that allow students to interact with educational content that enables the use of technologies such as Augmented Reality (AR), which uses smart devices like smartphones to reproduce 3D objects on a real plane. Salgado (2023) defines this technology as a system that promotes both the perception and interaction of real and digital objects in the same space.

In the restaurant industry, culinary blogs are among the main sources of up-to-date gastronomic trends; one of them is Barcelona Culinary. Hub , (2023) presents AR with various ways of adopting it in the gastronomic field, as a technology that has been adopted as part of the experience offered to diners, to create during their stay an immersion through their senses in addition to only using taste and smell to perceive aromas and flavors, since this technology is versatile, being able to project the shapes and colors of the ingredients in the dishes offered on the menu.

Another application of AR is adding virtual games while diners are dining. Waiting for their food, one of the uses that has become popular for public health reasons, according to Rojas (2023), is the 3D projection of digitized images of the menu offered by establishments.

Augmented reality and culinary education

reality is a flexible tool depending on the circumstances in which it is used. As Aguilar et al. (2023) mention , from its beginnings it was established as a tool that adapts to different scenarios and can be tailored to the needs of the user. The biggest deficiency of this technology over the years, and the reason why it has not been actively developed in the education sector in general, is that it is a very expensive technology that requires a certain level of knowledge in software development and 3D modeling .

To better understand, Quiñone z et al. (202 2) comment that access to new technologies can be intermittent for both students and teachers, since it depends on the availability, infrastructure and resources of the institution itself, therefore, educational programs that do not specialize in the study of emerging technologies such as gastronomy, hinder the acquisition and development of said technologies.

For its part, Augmented Reality in education according to Montenegro and Fernández (2022) has not been widely developed, only in some professions that, due to the characteristics of AR, allow the student to observe a certain object, interact with the position and perspective from where it is observed, for example, architecture, where its use is evident in the need to visualize three-dimensional objects such as buildings, houses or architectural structures that, in terms of their dimensions, are real size , without the need to have them physically present.

Augmented reality and artificial intelligence

In recent years, thanks to Artificial Intelligence (AI), the shortcomings in AR development have been reduced, both in terms of cost and human resources. Quinteros et al. (2021) mention that photogrammetry Combined with artificial intelligence, this results in a low-cost methodology for producing augmented reality by lowering the level of knowledge required about modeling and app development.

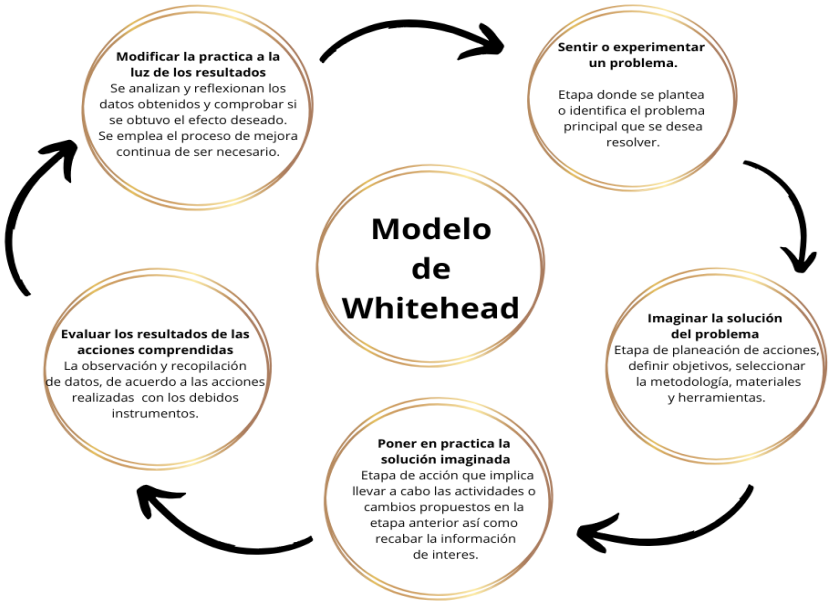
The function of these photogrammetry tools to generate 3D models operates by taking photos from all possible angles of the object so that AI can later digitize them, which, although this method is not functional for large-scale objects, can be applied to the restoration segment.

An example of an application that fulfills this function is Widar 3D. This app can be used from any smartphone, according to Widar's official website (*n.d.*). Furthermore, after generating the required 3D models with this type of app, you can use existing pages or applications that reproduce the 3D objects from an online server, or they can be developed to hold the data locally.

action research method, which is presented as a procedure oriented towards educational change that is built from and for practice, according to Rodelo et al. (2021) . It allows the groups involved to put into practice specific topics that generate new knowledge through their own experience, giving rise to a space that allows for continuous improvement.

This method is inspired by the Whitehead model, which presents a simplified five-stage model as shown in Figure 1.

Figure 1. Action research



Source: Own elaboration

Following the action research method, the main problem was identified, revealing the difficulty first-semester students have in correctly understanding or confusing the names, shapes, sizes, and vegetables to which the corresponding regular cuts are applied. This deficiency is observed in subsequent semesters, where students confuse the properties of each professional cut in the corresponding vegetables. Therefore, the need to introduce a new educational resource to address this deficiency was identified , with augmented reality (AR) being one of the best alternatives.

General objective

Implement a mobile application that allows analyzing the perception of the impact of augmented reality on the learning process of students in the gastronomy degree program at UAEH.

Materials and methods

An app called CulinaryVision, which allows the local visualization of AR on a smartphone , was used to analyze the students' experience when using this technology in the learning process.

The app was created through a platform that offers free licenses. Thanks to these licenses, augmented reality applications can be developed ; examples include Unity and Vuforia (Version 2022.3.1.17f1) . These are the best -known tools and have ... with a large community that collaborates for a better understanding of the platform, allowing even people without extensive knowledge to use it.

Similarly, the Widar app (Version 4.2.0), which requires a monthly subscription, was used to create 3D models using photogrammetry and artificial intelligence, making it easier for people with no basic knowledge of creating 3D objects.

The augmented reality app CulinaryVision was based on the recipe manual for the Gastronomy degree program at UAEH, featuring 10 markers that included techniques for the most common vegetable cuts, such as slices, batons and cubes, julienne, brunoise, jardinière, macedonia, soufflé, emincé, mignonettes, paillé, and allumettes, as well as cuts like chiffon and potato turnings. An additional marker was included, which redirected to a quiz so students could assess their knowledge of professional culinary cuts.

The sample consisted of 113 students, who were divided into three distinct groups, each with specific interventions . Each group underwent an intervention with a different objective, as shown in Table 1. All three groups followed a fixed structure that included answering the diagnostic questionnaire and receiving an explanation of the RA concept.

The presenter gave a demonstration to the data collection instrument validation group, where students observed the functionality of the CulinaryVision app. Meanwhile, the experimental group used the app simultaneously with an explanation of the topic of professional culinary cuts. Finally, the perception questionnaire and the evaluation quiz on the topic of professional culinary cuts were completed.

The control group's participation, in contrast to the experimental group, was differentiated by observing the use and operation of the app in the intervention that was provided after the theoretical and practical classes, compared to the experimental group where each student had the opportunity to properly use the CulinaryVision app.

Table 1. Interventions with groups

	App implementation time	Number of students	Evaluation priority	Information retention index	Number of interactions
Questionnaire and quiz validation group	One-off sample class, prior to the start of the semester	40 students	Perceptions of the CulinaryVision beta version: shortcomings, improvements, interests, and validation	Quiz validation	1
Control group	Recap of the topic after having theoretical and practical classes	35 students	Students' perception of the application's functionality with prior knowledge of the topic of interest	Assessment by means of a quiz	2
Experimental group	Theoretical class prior to practical session in cooking laboratories	38 students	Students' perception of the application's functionality without prior knowledge of the subject matter	Assessment by means of a quiz	3

Source: Own elaboration

The group validated the questionnaires and administered the evaluation quiz. This process was carried out in a single session before their cutting class. It began with the distribution of the diagnostic questionnaire, followed by a brief general explanation of AR and a demonstration of the CulinaryVision app via a presentation projected on a flat screen. Students were shown how to use the app and its functionality while the topic of professional cutting techniques, which they would use throughout the rest of their academic training, was explained. Next, they answered the perception questionnaire about the app and finally completed the evaluation quiz on the topic of professional cutting techniques.

The information obtained was used to make the corresponding adjustments to the questionnaires, evaluation quizzes, and observations of the application itself.

Group two was assigned as the “control group” with which the intervention began after they had the theoretical and practical class on vegetable cutting, so they would have a different perspective to the experimental group due to the prior acquisition of knowledge corresponding to the subject of professional cuts which contrasted in the use of the CulinaryVision app.

The previous intervention was structured similarly to that of the data collection instrument validation group. The diagnostic questionnaire was answered, followed by the evaluation quiz to relate the knowledge they had without the use of the app in the control group and with the use of the app in the experimental group. This was followed by a general explanation about AR and a review of the topic of vegetable cuts using the CulinaryVision app, showing the app in a live digital presentation on a flat screen. It should be mentioned that in the "control group" they had already studied the topic of professional culinary cuts. Finally, the perception questionnaire was answered.

Group one was chosen as the “ experimental group ”; only this group used and interacted with the CulinaryVision app. The intervention began with students completing a diagnostic questionnaire. They were then given a general explanation of augmented reality (AR), leading to their use of and interaction with the CulinaryVision app while the topic of professional cuts was being developed. Subsequently, the students entered the kitchen laboratories to carry out a practical class on vegetable cuts (Table 2). Finally, in the following theoretical class, they completed the perception questionnaire and the evaluation quiz on the topic of professional cuts.

Through the responses obtained from the perception and evaluation questionnaire, a comparison was made between students in the experimental group who used the app while the topic of professional cuts was taught and students in the control group, who were shown the app through a projection on the screen with which the classroom is equipped after having the theoretical and practical class , a process that is described in Table 2.

Table 2. Structure of the interventions

Validation group	Control group	Experimental group
	• Theoretical development of the topic and implementation of the topic in practical class	
Single intervention	First intervention	First intervention
. • Diagnostic questionnaire • Presentation and introduction to AR • Theoretical development of the topic and visualization of the CulinaryVision app • Implementation of the topic in practical class (Not applicable) • Perception Questionnaire • Assessment Quiz	. • Diagnostic questionnaire • Assessment Quiz • Presentation and introduction to AR • Recap of the theoretical topic and visualization of the CulinaryVision app	. • Diagnostic questionnaire • Presentation and introduction to AR • Theoretical development of the topic and visualization of the CulinaryVision app
	Second intervention	Second intervention
	• Perception Questionnaire	• Implementation of the topic in practical class
		Third intervention
		• Perception Questionnaire • Assessment Quiz

Source: Own elaboration

Design of instruments for data collection .

The data collection instruments for the students consisted of a semi-structured questionnaire made up of 22 items , based on the technology acceptance model as explained

by Calle et al. (2024) Two key elements stand out for this research: the perception of usefulness and the perception of ease of use .

The questionnaire was administered in two stages. The first stage was diagnostic, consisting of 9 items, and its purpose was to determine the students' general knowledge and experience with AR before using the app . The second stage addressed the perception of AR in the students through 13 items that they answered after having used or seen respectively the CulinaryVision app.

Seventeen professors who teach theoretical and practical courses at all levels of the Gastronomy degree program were given a questionnaire consisting of a diagnostic section and an opinion section on augmented reality (AR). This tool comprised 15 items in total, using different types of scales, such as Likert, satisfaction, frequency, and written rating scales, which allow for assigning a score. It also included a video about the uses of this technology in the food and beverage industry .

The questionnaires were conducted using the *Google Forms platform*, in addition to using the observation method as a data collection method in the practical class to determine the influence of the CulinaryVision app on students during the execution of the required techniques.

The assessment instrument was constructed in the form of a quiz. with 10 questions on the topic of professional haircuts, which was answered and validated by group three through the Quizizz platform . Subsequently , it was applied to the experimental and control groups after they had their respective practical sessions, as Sánchez (2025) indicates , the action-research method can collect qualitative information, carrying out surveys with Likert scale to gather data on the perception of the students, so that assigning a score to the information retention index in the collective evaluation facilitates the comparison between the experimental and control groups.

Results

The data obtained from the diagnostic survey in the experimental and control groups identified There was clear confusion among the students regarding their knowledge of AR . 86.5% of the experimental group responded that they did have knowledge about augmented reality, while 13.5% of the students did not . Meanwhile , in the control group, very similar results were obtained, since 86.8% had heard of AR and 13.2% had not (Table 3).

Table 3. Prior knowledge about AR

Have you heard of augmented reality?		
	Experimental group	Control group
Yeah	86.5%	86.8%
No	13.5%	13.2%

Source: Own elaboration

The confusion became evident when students attempted to define AR. In the experimental group, only 36.8% correctly defined AR, while the remaining 63.2% confused it with VR , other types of AI software , or stated they did not know what AR was. In the control group , a change was observed, with 47.4% answering correctly and the remaining 52.6% unable to define AR (Table 4).

Table 4 Definition of RA

Could you explain what augmented reality is?		
Possible answers	Experimental group	Control group
A technology that creates a virtual environment within a smart device	52.6%	34.2%
A technology to improve digital photographs	0%	0%
A technology that overlays digital elements onto physical spaces in real time.	36.8%	47.4%
A 3D video editing software	5.3%	2.6%
I don't know what Augmented Reality is.	5.3%	15.8%

Source: Own elaboration

Regarding the perception survey, it was found that satisfaction with using the CulinaryVision app in the experimental group was 52.5 %, while 42.4% responded neutrally regarding their satisfaction and 6.1 % were dissatisfied.

In the control group, overall satisfaction was 76.7%, 20% remained passive in their response, and only 3.3% were dissatisfied . This difference between the two groups demonstrates a significant difference. When using the app before having the practical cooking class with the experimental group and when using the app after having the practical cooking class with the control group, since having the practical experience of the class of cutting vegetables and greens showed a higher percentage of satisfaction (76.7%, in the control group) with the use of the CulinaryVision app (Table 5).

Table 5. Overall app satisfaction

How would you rate your overall satisfaction with the CulinaryVision app interaction?		
Possible answers	Experimental group	Control group
Very dissatisfied	6.1%	3.3%
Dissatisfied	0%	0%
Neither dissatisfied nor satisfied	42.4%	20%
Satisfied	39.4%	60%
Very satisfied	12.1%	16.7%

Source: Own elaboration

Regarding the students' assessment of whether the CulinaryVision app helped them better understand the topic of professional cuts, 78.8% of the students in the experimental group mentioned that it did help them improve their understanding, while 21.2% felt the opposite.

On the other hand , in the control group, it was shown that 93.3% of the students considered that the app did help them to better understand the topic of professional cuts and only 6.7% thought the opposite, again highlighting that the use of the CulinaryVision app after having the practical class of interest in the control group, the students better understood the usefulness and advantages that the app provides, compared to the experimental group (Table 6).

Table 6. Understanding of the topic of professional cuts

Do you feel that the CulinaryVision app improved your understanding of the topic of vegetable cutting?		
	Experimental group	Control group
Yeah	78.8%	93.3%
No	21.2%	6.7%

Source: Own elaboration

Regarding the students' opinions on how the CulinaryVision app could influence their education, various responses were obtained. In the experimental group, 30.3% mentioned that 3D visualization helped develop their creativity, a crucial skill in the culinary field . Meanwhile, 27.3% commented that incorporating new technologies would aid their professional development, 18.2% responded that having engaging classes that capture their attention, as with the app, would strengthen their education, 15.2% believe it could foster self-directed learning or provide visual feedback, since they can use the app at any time, and 9.1% believe that using the app would not benefit their education.

Meanwhile, 20% of the control group felt that it would help incorporate new technologies into their education, 23.3% felt that 3D visualization would contribute to better developing their creativity, while another 20% believed that having more interesting classes would help to better capture their attention, and finally 36.7% commented that it could generate self-learning or feedback using this technology, a different case from the experimental group, which had 9.1 % who felt that this technology would not contribute to their education (Table 7).

Table 7. Reinforcement of the app in student education

In your opinion, what feature of the CulinaryVision app do you think helps your culinary education?		
Possible answers	Experimental group	Control group
I would incorporate new technologies into my education	27.3%	20%
3D visualization would help me to better develop my creativity	30.3%	23.3%
I would have interesting classes that would help capture my attention more.	18.2%	20%
It could generate self-learning or feedback using this type of technology	15.2%	36.7%
I don't think it will help my education	9.1%	0%

Source: Own elaboration

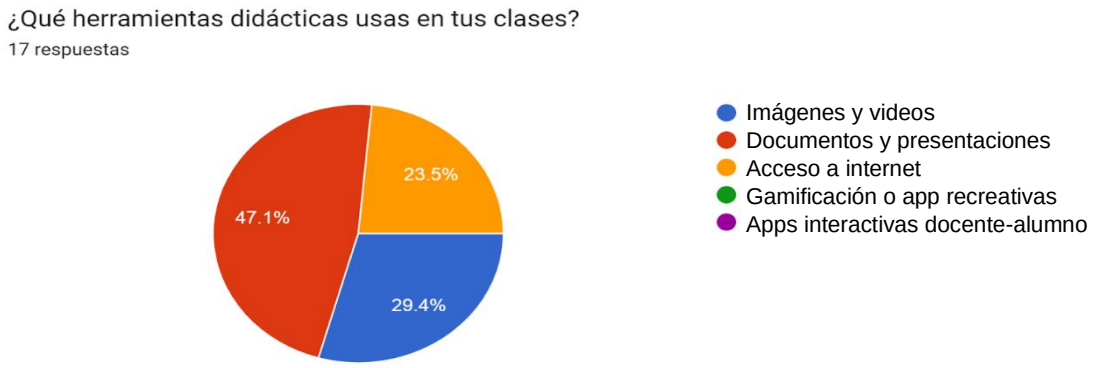
In the data obtained from the survey of teachers on the perception of the use of AR in culinary teaching, it was observed that 52.9% strongly agree, 29.4% agree and 17.6% strongly disagree on the introduction of new technologies (Figure 2).

Figure 2. Incorporation of new technologies for teaching

Source: Own elaboration

However, despite the various teaching tools available to teachers to complement the teaching process thanks to the extensive development of technology, 47.1% use documents and presentations, 29.4% use images and videos , and 23.5% use free internet access. According to the responses obtained, teachers in the Gastronomy degree program at UAEH do not use methodologies such as gamification or recreational apps that interact with students. (*Figure 3*).

Figure 3. Use of teaching tools in class



Source: Own elaboration

Although teachers use traditional technologies as teaching support, the introduction of AR in culinary education demonstrated its great versatility as a teaching tool. This is shown in Figure 4, where 70.6% believe it could be very useful in the students' training process, 23.5% think it could be useful, and finally 5.9% believe it is not very useful.

Figure 4. Usefulness of AR in student learning

Source: Own elaboration

Discussion

In general terms, according to the data obtained , both groups had an accurate understanding of what augmented reality is (Table 3 *)* , however, a clear confusion was noted when defining this technology because they are conceptually similar, therefore, it is necessary to detail the qualities of each technology as they maintain Pimentel et al. (2023) both technologies can emulate 3D objects, however, VR only does so in a completely digital and immersive environment, while AR emulates it in a real-time environment.

Based on the above observations, it is important to thoroughly analyze the topic so that students can better understand AR (Table 4 *)* , its scope and possible applications in their area of study, thanks to its versatility.

On the other hand, the satisfaction that the groups had when using the CulinaryVision app (Table 5 *)* shows significant differences, George (2020) mentions that students feel an attraction to the use of AR in education because it is a technology that attracts their attention and motivates students to get involved in the learning process , which is considered by researchers as a key factor for gastronomy, a highly practical profession in the educational field .

Students who have not previously had an educational experience with this type of technology may be influenced in the way they have contact with said technology. Romero et al. (2023) mention that previous interaction can affect the perception of the use of this technology ; however, it does not represent a significant change because the results are based on a single group, while the results of the experimental group , which, having no notion about the function of this app in the practical part, presents a greater proportion of skeptical responses (Table 6 *)* .

As for the app test of the control group after having experienced the practical class, it generates a positive opinion based on the knowledge acquired in their practical session, which, consequently, according to the data obtained, although it is not a significant difference, the prior knowledge of the topics does influence the perception of the use of AR.

Each student has a different way of learning, therefore it is necessary to change the way of communicating between teachers and students, Barboto et al. (2025) It mentions that AR is a tool with which students can interact while a theoretical class is being conducted, because if the topic presented is correctly posed, students can observe digital concepts close to how they are in reality, generating different opinions among students about the importance

and influence of this technology in their education (Table 7 *),* as the study states, especially in topics with concepts that through traditional methods may be confusing or ambiguous.

Teachers, despite having a large number of teaching resources , use the same teaching tools, as shown in *Figure 3.* As Córica (2020) points out, teachers face a great challenge due to the habitual use of traditional teaching methods and tools. Even though their opinion is mostly in agreement on incorporating new technologies for teaching, this shows that there is a sense of resistance to change (Figure 2 *)* , in addition to the challenges that teachers face when trying to include a new technology in their teaching process as Aguilar et al. (2023) point out, this is due to the lack of experience in the use of ICT, the difficulty that teachers find when trying to introduce it into their teaching process and the resistance to change maintained by teachers with long educational careers.

After teachers observed the possibilities that AR offers in gastronomic education, most of them agreed that it is a very useful technology for student learning (Figure 4 *)* although this opinion may be affected by the content of each theoretical and practical subject they teach.

Finally, when the evaluation was carried out through a quiz, the results obtained were that the experimental group obtained an accuracy of 79% when answering the quiz, while the control group obtained 62% accuracy, so from the previous data in the research it is inferred that using the CulinaryVision app in the experimental group while the theoretical class was developed was more efficient than in the case of the control group.

The results obtained do not show a notable impact because the quiz was carried out without prior use of the app, as Pimentel et al. (2023) state that AR is a technology that is constantly changing, as AR evolves it is easier to notice the improvement that this tool presents and also the performance that its users acquire with respect to the impact of their learning.

Conclusion

This research analyzed the perceptions of students and teachers regarding the introduction of augmented reality as a teaching tool . Participants perceived this technology as a useful and innovative instrument for teaching and learning culinary education .

AR is a technology that is being introduced into a discipline with a high practical component, in which, although its application in the culinary education sector has not been explored, the acceptance of this technology has been positive.

It is concluded that the use of this technology by students of the Bachelor's Degree in Gastronomy at UAEH presents various benefits as it is an educational and interactive tool that helps to understand the concepts by creating realistic and dynamic simulations, for the differentiation of cuts in the various vegetables and greens .

was identified among teachers due to the difficulty of transitioning to the use of new technologies; however, teachers show a willingness to introduce AR in their disciplinary area . It is recommended to implement training programs for a better understanding of their use, in addition to emphasizing the advantages offered by including new technologies as teaching tools .

Finally, although AR presents challenges in gastronomy teaching methodologies, the benefits it offers, such as content retention , increased student interest, versatility as a teaching material, and real-time object visualization, were observed to facilitate teachers in creating a digital environment that adapts to the learning needs of UAEH students.

Future lines of research

Future lines of research on the use of augmented reality in culinary education can be directed to different areas, for example, the design and development of AR, creating educational materials that adapt to the learning needs of students to be used as teaching tools in the classroom, as well as the accessibility of the technology for AR, developing low-cost augmented reality applications or content.

The research can also be projected onto teaching methodologies with AR, Narváez (2020) mentions that specialized methods can be defined in gastronomic teaching or by making comparisons of traditional teaching methodologies in contrast to teaching using augmented reality.

also include methodologies not commonly used in culinary education, such as gamification for specific topics. Additionally, it should incorporate hybrid teaching methodologies that benefit institutions with executive or blended learning programs by creating digital learning environments that can be used outside the classroom, including feedback and self-directed learning.

While this research shows technological barriers that teachers face regarding the use of new technologies, it did not aim to analyze or create strategies for their implementation. Therefore, expanding on this topic is essential because the difference in abilities to manipulate new technologies between teachers and students makes it necessary to shorten this digital divide .

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