

A Study of Using The 3DH To Achieve the Required Bakery Skills Among Students at A Private University in Bangkok

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Abstract

The traditional teaching methods incorporated with 3D Hologram technology are being analyzed in this experiment to get the desired student outcome and to see how much knowledge is retained using the 3DH teaching method. Even though there is a lot of work published in this field, the 3DH teaching approach has not fully developed in the culinary area. Students from the International Hotel Management program that are enrolled in the Culinary Arts subject have been used as the sample for the experiment. Through quasi-experimental research, the effectiveness of the 3DH teaching approach was tested by comparing pre-test and post-test results. At the end of the experiment period, a satisfaction survey was administered to determine the learning experience and adaptiveness of the learning approach. Results revealed that there was a statistically significant difference in the pre-test scores ($M = 42.67$, $SD = 6.28$) and post-test scores ($M = 50.23$, $SD = 6.44$); $t(29) = -7.72$, $p < .001$. These results of the pre-test and post-test indicated that the hologram used as the treatment had a significant effect in favor of the experiment, suggesting that the hologram condition increases performance in bakery skills, and this improvement is statistically significant. Based on the analysis of the Satisfaction Survey, the data suggests that the students were prone to technology and that they were able to adapt themselves to the way in which they were being instructed in performing the required bakery skills. The criteria that were used to describe their experience included the skills required for the production of bakery products. The experiment revealed that there were some limitations to the learning approach, but overall proved that this method of intervention can improve students' practical performance in the kitchen.

Keywords: 3-Dimensional Hologram (3DH); Augmented Reality (AR); Virtual Reality (VR); Culinary Arts (CA); 3D Holographic Fan (3DHF)

Introduction

This paper discusses a specific technological advancement in education which is still in its development stage, and that is the use of holographic instructional mode for teachers and students, or may be referred to as 3D Hologram Technology. “While this emerging technology is still in its infancy and is cost prohibitive today, it is probably a pretty reasonable assumption that it will become increasingly affordable and commonplace in years to come, following the natural path of many powerful technologies” (Walsh, 2012). This mode of teaching gives the students a clearer visual display of imagery and a better understanding of the concept and design.

The paper also describes the rate at which 3D Holographic Instructions are advancing as an effective teaching tool in attracting students' attention and enhancing their understanding. Research states that 3D Holography will be able to break up/categorize a complex topic to a simpler form, which improves the ability of students to understand and comprehend compared to a 2D picture or videos. “True 3D display is the “holy grail” of visualization technology that can provide efficient tools to visualize and understand complex high-dimensional data and objects” (Geng, 2013).

Authors Orcos and Magreñán (2018) state in their research article that that the hologram has great potential in the classroom due to the fact that it enables to create a collaborative environment from a constructivist point of view and also student adapt to the visual display of instructions, this enabling an imitative environment form a behavioral point of view. Preliminary results the research paper by authors Khan, Mavers and Osborne (2020), strongly suggest that holograms can support learning process. go on to state that. Moreover, authors Kalansooriya, Marasinghe and Bandara (2015) state that implementing 3-Dimensional Holographic Technology (3DHT) on education is that it offers a convincing and realistic view for the user as, it has the ability to communicate with viewers in different location at the same time, and it can also assist in bringing out famous character to life that could be useful in teaching.

With the introduction of multiple technologies, especially in the education field, teaching and learning has become more digitized. Herold (2016) states that “In many schools, students are given district-owned computing devices or allowed to bring their own devices from home. The idea is that this allows for “24-7” learning at the time and location of the student’s choosing”.

“Through many technological tools that teachers have at their disposal, they try to make the learning process fun, interactive, and informational for students by engaging them and giving them a sense of independence” (Bajraktari, 2020). In the light of this, it is evident that people today are striving at every point to provide advanced technology to educate students which would see benefits for both teachers and learners.

This paper seeks to provide valuable insight for hotel management educators to integrate 3D Holographic technology into a blended learning mode where the theory will be traditional classroom mode of learning and the technological treatment will be the 3D Hologram which will be aimed at enhancing the practical skills in the Culinary Arts subject.

Research Objectives

1. To determine the effectiveness of the blended learning approach using the holographic treatment on students to achieve the required bakery skills in the kitchen.
2. To determine student satisfaction of the blended learning approach using the holographic treatment

Background

As the world is changing, so must the teachers. Technology has now become a way of life and plays a big role in schools today. Technology has the ability to make aspects of education easier and more equitable in many ways. Incorporating technology in the classrooms can support and benefit teaching and learning activities.

Some of the ways in which technology can benefit the teaching and learning process is illustrated below:

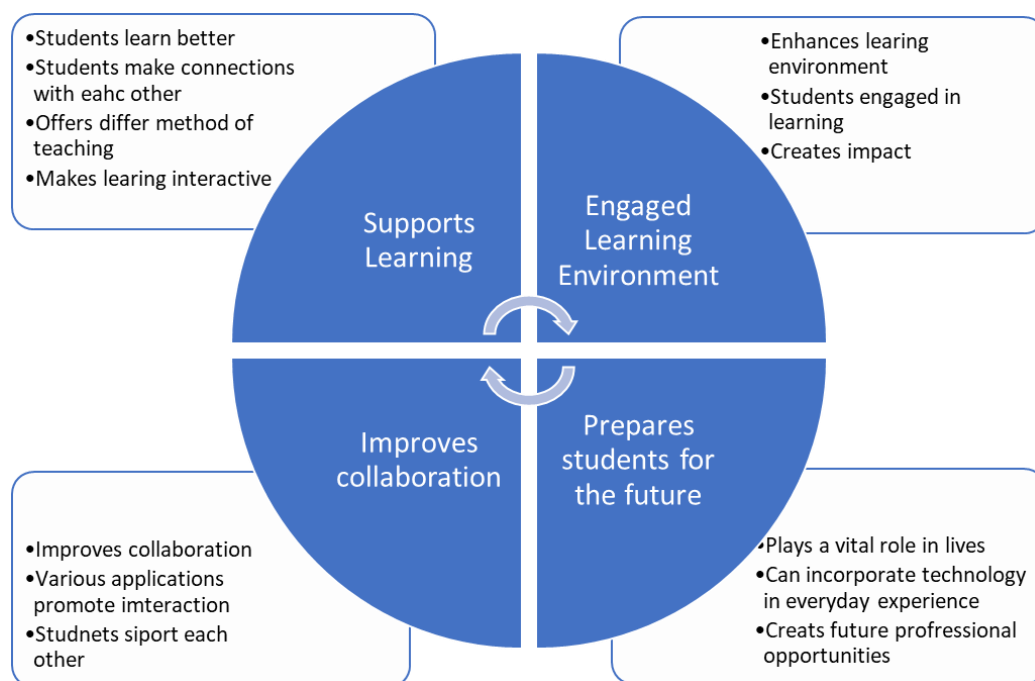


Figure 1: Influence of Technology in Education

If educational institutes can rise to the challenge presented by the ever-evolving nature of technology, students will be able to discover the limitless potential of their ability and to take advantage of many opportunities that have yet to present themselves.

Literature Review

Over decades, cooking technologies have changed, and with those changes, the demand for skilled cooks, being able to use those technologies, has increased. “Nowadays, most aspiring cooks learn the theory of cooking prior to facing and experiencing the reality of the culinary world. It is in both culinary classrooms and teaching kitchens where educational technologies are now being integrated as part of the educational process” (Glass, 2005). It is very evident there is no question that technology is now a permanent part of the hospitality and foodservice business.

Streaming video is another technology, which, according to Strom (2002), is a low resource, cost effective and easily delivered manner of instruction. Streaming videos allows for images to be sent to a computer without needing to be downloaded. In most instances, there is no sound attached to the video images. The streaming video can be repeated in a loop, constantly played, or upon demand giving the culinary students an easier visualization of the dish to be prepared.

Other concepts that could become commonplace include interactive touchscreen cooktops that allow you to prepare food while browsing the web, 3D printers that create food, and appliances that can send messages to smartphones telling us how many bottles of beer are left in the fridge, among other things (Morris, 2014).

Authors Orcos and Magreñán (2018) state in their research article that the hologram has great potential in the classroom due to the fact that it enables to create a collaborative environment from a constructivist point of view and also student adapt to the visual display of instructions, this enabling an imitative environment from a behavioral point of view. Preliminary results the research paper by authors Khan, Mavers and Osborne (2020), strongly suggest that holograms can support learning process. go on to state that. Moreover, authors Kalansooriya, Marasinghe and Bandara (2015) state that implementing 3-Dimensional Holographic Technology (3DHT) on education is that it offers a convincing and realistic view for the user as, it has the ability to communicate with viewers in different location at the same time, and it can also assist in bringing out famous character to life that could be useful in teaching.

Moreover (2017) expresses the inclusion of VR headsets where people get integrated with technology in producing food. According to Cobe (2021), Ruoxbe Culinary School's chief culinary officer stated that enrollments had increased during the Covid 19 pandemic. The author expresses that in the current Covid 19 pandemic period, technology integrated culinary arts programs are increasing exponentially. Whether the mode of instruction is videos, PowerPoint presentations, interactive software, virtual reality, etc., they can all be integrated to give students a good educational experience.

Conceptual Framework

The design of research is the 'quasi-experimental' research designs. The quasi-experimental research model used is developed based on the Pre-Test/Post-Test model as shown below:

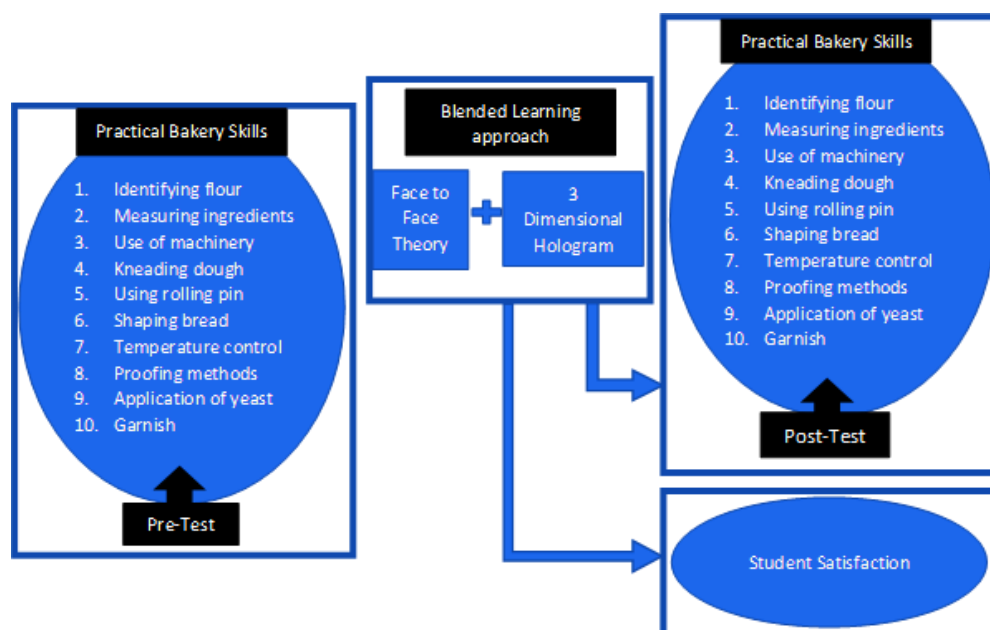


Figure 2: Quasi Experiment Research Design

Students who will be the subject of study will be briefed on the experiment at the beginning of the term. The student sample, which consists of 30 students, will be given the Pre-Test from which the first set of data will be collected. This test evaluated the students' practical bakery skill sets before the beginning of the Culinary Arts subject in that term by using the program's evaluation scoresheet and rubric. The students were given 3 hours to work in the kitchen where they were evaluated for the Pre-test. After the Pre-Test had taken place, the sample students then commenced their learning using the 3DH teaching tool for the coming term.

At the end of the experiment, a satisfaction survey was completed by the student sample to evaluate their learning experience using the 3DH teaching approach. A Thematic Analysis was used for analyzing the open-ended responses by the students obtained from the survey.

Problem Specification and Motivation

Implementation of 3D Holographic Technology faces quite a few challenges in the field of education. The main challenge or limitation that is currently being faced in this experiment is the lack of attention that the instructor pays to individual students in the kitchen area.

The kitchen practical area at the university starts operation from 0830 hrs. Students in the kitchen have to prepare the menu and have everything ready by 1130 hrs. This gives them just about 3 hours to prepare an extensive menu. The problem is that the instructor finds it very

difficult to allocate time to individual students or a small team doing one particular job or dish for the day's menu. In this regard, a 3D hologram can help in the demonstration of the recipe giving enough time for the teacher to pay attention to other aspects of the kitchen. A 3D hologram is more likely to increase motivation for learning and improve student engagement. It provides a unique and exciting learning experience which is normally not evident with traditional teaching methods. So therefore, by incorporating 3D hologram technology into the practical kitchen area, teachers have the option of creating a more dynamic and interactive learning environment that can help students to better understand and retain kitchen skills.

Background of Hologram as part of Augmented Reality

According to Dolega–Dolegowski et al. (2022), the authors claim that holographic based–technology can be successfully used in education and that students have the opportunity not only by reading and watching videos, but by themselves in the enhanced transparency.

Holograms have many practical applications, including in medicine, art, and security, but they are also increasingly used in augmented reality experiences. When combined with a digital device, such as a smartphone or tablet, holograms can be used to create interactive and immersive experiences. For example, a hologram could be used to display a virtual object that appears to be floating in mid–air, or to project an image of a person that looks as though they are actually in the same room as the viewer. “The 3D objects viewed can be defined and driven by the instructor or learner. The personalized content selected for viewing can relate to the learning task at hand.” (Holland, 2019). Holograms are powerful tools for creating immersive and interactive augmented reality experiences.

3DH as a Teaching Tool compared to traditions teaching methods at the University

Salim (2019) says that in traditional education methods, attention to teachers and instructions is enforced. But sometimes, says the author, the students do not make an effort to listen to the teachers which decreases their interest in the lectures and become passive listeners.

The Practical Component of the Bakery Skills at the University Is Done in the Kitchen Where Students Have a Hands–on Involvement in the Preparation of Bakery Products. However, the Workflow for the Students Is Not Very Convenient at the Moment, as There Is Just One Teacher in the Kitchen That Plans and Organizes All the Work That Takes Place, Including Teaching and Demonstration of the Bakery Items Required to Be Prepared. Learning From This Approach Using the 3DH Teaching Tool Will Surely Stimulate the Students in This Innovative Way to Take in

New Information. With the Increased Interaction Comes a Greater Chance of Content Gain and Retention, and the Opportunity to Enhance Spatial Thinking and Practical Skills. “This Will Help Them to Clarify the Concepts in a Better Manner and Will Enhance the Way Students Learn. When the Concepts Are Showcased in Front of Students’ Bare Eyes, Then They Can Easily Understand Concepts Very Easily” (Jha, 2019).

Equipment used

The equipment used in the experiment is a Spin Display 3DH Fan. It is an android intelligent system that supports Bluetooth audio/supports mobile phones/computer wireless projection screen. It exhibits real-time interaction and is suitable for exhibition, remote conference, and other application scenarios. The Spin Display 3DH Fan is portable and a flexible operation with its own material library and its own text logo function

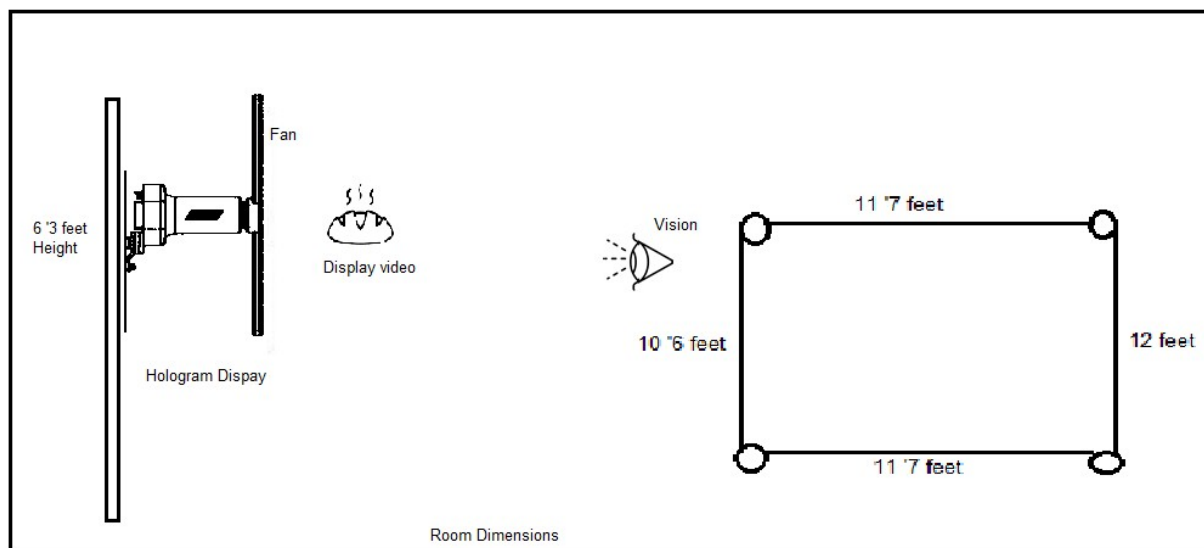


Figure 3: How the hologram works.

Source: 3D Hologram Advertising Fan 50cm 4 Blades APP/WiFi control 3D LED Fan (yh3dhologram.com)

The 3D Spin Display is mounted on the wall. The video is then projected through the Spin Display application that is installed on the laptop. The video is then operated via the laptop which when played, projects the image in a 3D holographic display. The students are positioned approximately about 2 meters away from the projection. Once the video image is played, the students then look at the video, follow the instructions, which now gives a totally enhanced imagery of the bakery product that needs to be produced.

Research Results

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre Test	.076	30	.200*	.989	30	.988
Post Test	.108	30	.200*	.980	30	.835

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Figure 4: Test of Normality for pre-test and post-test grades

Due to the normality of the data (Figure 4), to test this hypothesis, a paired t-test (Figure 5) was used to analyze the pre-test and the post-test results. There was a statistically significant difference in the pre-test scores ($M=42.67$, $SD=6.28$) and post-test scores ($M=50.23$, $SD=6.44$); $t(29)=-7.72$, $p < .001$. These results imply that hologram usage has a statistically significant effect in favor of the post-test scores, suggesting that the hologram condition increases performance in bakery skills, and this improvement is statistically significant.

Paired Samples Statistics					
	Mean	N	Std. Deviation	Std. Error Mean	
Pair 1 Pre Test	42.67	30	6.277	1.146	
Post Test	50.23	30	6.436	1.175	

Paired Samples Correlations				
	N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1 Pre Test & Post Test	30	.662	<.001	<.001

Figure 5: Paired Sample t-test statistics

The line graph below indicates the difference and the increase between the pre-test and post- scores of the students in this experiment.

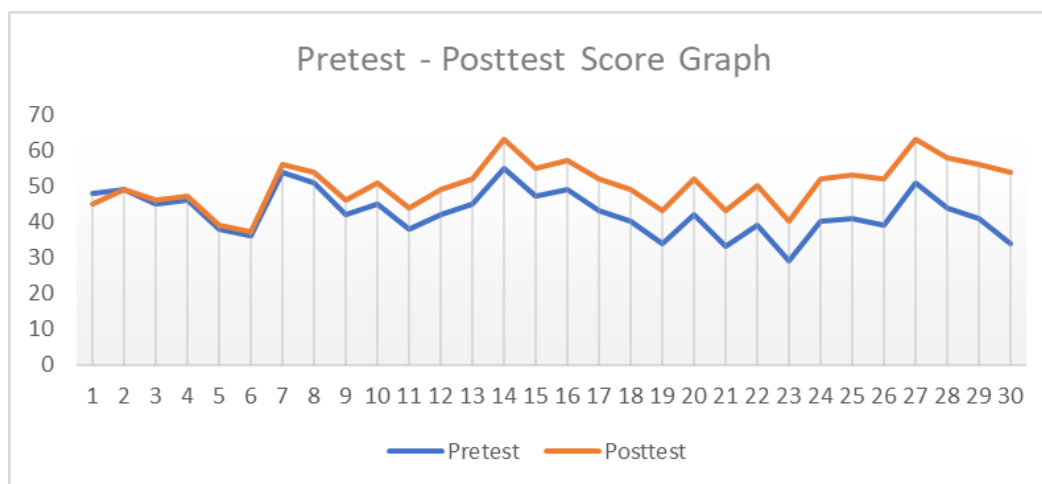


Figure 6: Pre-test and Post-test graph

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.849	.846	12

Figure 7: Reliability Statistics

Cronbach's Alpha quantifies the level of agreement on a standardized scale of 0 to 1. Higher the value indicates higher the agreement. In this case, Cronbach's Alpha is .849, which according to the scale in Figure 8, indicates good internal consistency

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Figure 8: Cronbach's Alpha Reliability Scale

Mean values and Standard Deviations of the Students' Perceptions towards the Use of Hologram

No.	Satisfaction Survey Items	Mean Value	Standard Deviation
1	I was able to identify bakery ingredients.	4.00	0.69
2	I was able to appropriately measure ingredients.	4.10	0.66
3	I was able to handle bakery equipment.	4.07	0.58
4	I was able to knead dough to the required softness.	3.13	0.51
5	I was able to correctly use the rolling pin.	4.10	0.55
6	I was able to apply different techniques of shaping bread.	3.30	0.65
7	I was able to adjust the needed baking temperature.	4.03	0.72
8	I was able to correctly apply proofing methods	3.23	0.57
9	I was able to correctly use the right amount of yeast.	4.10	0.66
10	I was able to apply the correct garnish to different items.	3.57	0.68
11	I am satisfied with this approach of learning.	3.10	0.61
12	I want to continue learning recipes using this approach.	3.10	0.71
Average		3.65	0.63

Figure 9: Item Statistics

The students agreed that they were able to identify the ingredients used in the production of the bakery product (with a mean score of 4.00) and that they were able to measure the ingredients with ease (with a mean score of 4.10). The students agreed that they were able to handle the required equipment used in the production of the bakery product (with a mean score of 4.07) but remained neutral when it came to kneading the dough to the required softness (with a mean score of 3.13). The students also agree that using the rolling pin demonstrated by the hologram was easy to follow (with a mean score of 4.10) but remained neutral when it came to shaping bread using different techniques (with a mean score of 3.30). When asked to adjust the oven to the desired temperature, students agreed it was easy to follow (with a mean score of 4.03) but when it came to the techniques of proving bread, the students remained neutral (with a mean score of 3.23). The students also agreed that using the correct amount of yeast for the bakery product was easy (with a mean score of 4.10) and they agree that they were also able to apply the techniques of garnishing the product (with a mean score of 3.57). When asked about the satisfaction of this learning approach using the technology, students remained neutral (with a means score of 3.10) and also remained neutral on wanting to learn more using this approach (with a means score of 3.10). Overall, the students agree that this method of learning using

holographic technology and a medium of instruction helps them to learn more favorably from the traditional method of learning.

After individual analysis, the above table indicates the mean of the survey questions that were posed to the students to retrieve the satisfaction results. On a Likert Scale of 1 – 5, the mean for each question is indicated in the table, which depicts a high level of agreeability to the hologram intervention. The low standard deviation indicates that the values are closer to the means and have a low level of variance.

Synthesis: Based on the conceptual framework, the students were tested before the beginning of the experiment for their bakery skills as the pre-test. The students embarked on the experiment engaging in the blended learning mode where the theoretical input was delivered using traditional classroom method and the practical component was administered using the 3D holographic treatment. At the end of the experiment, the students were then tested for their bakery skills as the post test. The scores between the tests revealed that there was significant improvement in bakery skills compared to the beginning of the experiment. The satisfaction survey also revealed that the students were adaptable to the 3D technology and that the students had a positive learning experience.

Discussions

The review of the research findings addressed demonstrated how the blended learning approach using the holographic intervention makes a significant improvement in terms of the skills required in the bakery section of the kitchen to produce the desired bakery product in the existing learning environment established by the university.

The review of the research findings demonstrated how the blended learning approach using the holographic intervention makes a significant improvement in terms of the skills required in the bakery section of the kitchen to produce the desired bakery product in the existing learning environment established by the university.

The positive improvement of the bakery skills could be supported by the design of the learning approach using holographic technology. The research study assessed the learning environment so that the blended learning approach using holographic technology could be appropriately implemented. The implementation of the technology was conducted based on the literature related to Virtual and Augmented reality that is being implemented in schools today,

where the effectiveness depends on the aspects of the equipment itself, the students learning through the technology and the environment in which the learning takes place (Iatsyshyn, 2020).

The results from the satisfaction survey can be interpreted that the participants had an interesting learning experience and that most of them were willing to continue learning using the holographic treatment, whereas some of the students were not able to adapt to the technology and stated that they would be more comfortable if they were to be instructed by the teacher, rather than the technology.

Some limitations associated with this technology are the cost of equipment and implementation, required speed of internet, effectiveness of the technology itself and the level of interaction. Since we are dealing and basing our instruction on human interactions, every cohort of students that come in has different capacities and ability to learn. Some learn slowly and some learn fast. Another limitation is that students may get distracted by this novelty in teaching and give little attention to what they are supposed to be doing and get distracted themselves by being involved in the technology itself. Developing a hologram will not identify the caliber of the students but project the recording to all, irrespective of student capabilities.

This study concluded that there is a considerable potential for the university to adopt this mode of blended learning in the hotel management program. According to Walsh 2012, this holographic technology as a medium of instruction is still in its infancy stage. The author goes on to state that it will become the norm in the future, and also increasingly affordable.

Conclusion

The results of this research study have proved that the 3D hologram is an effective tool as a medium of instruction. At the same time, using the 3D hologram technology is an important approach so visualization skills of students can be improved in order to develop abstract imagination of concepts. It can also be used to improve the students' perception in order to understand the concepts of the learning topics as they get to have a better understanding of what they are learning.

Almost all students showed a positive attitude and eagerness for learning using the hologram. But some of the students expressed that they were not sure if the kitchen practical skills were to be taught using the hologram technology.

According to authors Yan et al. (2022), there is a huge potential in the development of hologram technology in the future. The authors believe that with the improvement of technology,

the subsequent development of hologram technology and its likes will provide more satisfaction to the end users and will be able to make a greater contribution to society.

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