

Using VR as a New Pedagogical Approach for Food Science and Technology Education in Hong Kong

Hin-Yeung Chan¹ and Sze-Tsan Clifford Choy²

¹Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic University, Hong Kong SAR, China

²School of Design, The Hong Kong Polytechnic University, Hong Kong SAR, China

shaunleochan2003@gmail.com

mccliff@polyu.edu.hk

Abstract: This study explores the potential of Virtual Reality (VR) as a pedagogical tool for teaching Food Science and Technology to junior secondary students in Hong Kong. Traditional cooking education faces significant challenges including safety risks, resource constraints, and limited hands-on practice opportunities, issues particularly acute in Hong Kong where teacher shortages and lack of standardized textbooks compound these difficulties. The VR game was designed specifically for entry-level junior secondary students, incorporating scaffolded learning of both theoretical food science concepts and practical cookery skills aligned with Hong Kong's Technology and Living curriculum. Unlike traditional digital games, the VR environment enables three-dimensional spatial visualization of cooking processes, hand-tracking for motor skill development, and immersive procedural learning that closely mimics real kitchen experiences. This teaching experiment compared learning outcomes between students using a custom-developed VR cooking game ("Food Science Academy VR") and those watching video recordings of the same content. Four Secondary 1 (Grade 7 / K7) students participated in the experiment, with two engaging in VR gameplay and two viewing recorded gameplay videos. Assessment included both written tests and practical cooking tasks. Preliminary results indicated that VR users demonstrated superior knowledge retention and practical performance, though the study acknowledges significant limitations including the small sample size and the artificial nature of the video control condition, which does not represent actual traditional teaching practices in Hong Kong schools. While findings are preliminary, they suggest VR's unique affordances—particularly spatial visualization and embodied interaction, may offer advantages over both passive video instruction and potentially traditional methods for teaching procedural cooking skills. However, questions remain about the resource feasibility of implementing such technology in Hong Kong's educational context.

Keywords: Virtual reality, Food science and technology education, Junior secondary education, Cooking skills training, Immersive learning, Hong Kong curriculum

1. Introduction

The teaching and learning of cookery, consisting of both practical skills and theoretical knowledge, holds significant value not only within educational settings, but also in professional culinary contexts and everyday life. However, traditional approaches to Food Science and Technology education face persistent challenges, including ensuring student safety during practical sessions and managing substantial time requirements associated with hands-on practice, preparation, and cleanup activities.

The situation is particularly acute in Hong Kong, where the Technology and Living (T&L) curriculum faces critical resource shortages. According to recent legislative council data, only 430 Home Economics or Technology and Living teachers serve across 440 secondary schools, representing a severe personnel shortage (Inmedia, 2025). This has led to widespread subject discontinuation, with only 13 schools offering Technology and Living (Food Science and Technology) at senior secondary level, enrolling merely 524 students in 2023/24—a decrease from the previous year. The Hong Kong Diploma of Secondary Education examination saw only 113 candidates in this subject, representing a 40-person decrease from the previous year (Inmedia, 2025).

A 2017 survey by the Hong Kong Federation of Education Workers revealed the systemic nature of these challenges. While 87.8% of 288 responding schools offered junior secondary Home Economics, only 20.2% provided senior secondary Technology and Living (HKFEW, 2017). The primary barriers were lack of qualified teachers (74.9%) and absence of appropriate facilities (54%). Many schools reported having only one professionally trained teacher, with 195 schools having no teachers with relevant professional training for senior secondary Technology and Living subjects (HKFEW, 2017).

The hardware infrastructure challenges include inadequate cookery facilities and specialized equipment costs. The software challenges refer to insufficient human expertise, with 99% of survey respondents believing teachers require professional training, yet many schools lack adequately trained personnel (HKFEW, 2017). Legislative Council member Leung Tze-wing has expressed concerns that continued decline may affect talent

supply in food science industries, potentially requiring imported specialists to address gaps in local expertise (Inmedia, 2025).

These challenges are compounded by Hong Kong's specific educational context, where junior secondary students often have minimal cooking experience due to many households employing domestic helpers for meal preparation. This unfamiliarity with basic kitchen equipment reflects broader societal patterns and creates additional pedagogical challenges. Moreover, the T&L curriculum's emphasis on developing "positive values and attitudes for the well-being of families and society" (EDB, 2017) suggests that cooking education serves broader purposes beyond skill acquisition, including social and cultural dimensions that traditional classroom cooking provides through shared experiences.

Despite these challenges, educators recognize substantial benefits these subjects provide. The survey indicated 92.3% of respondents believed the subjects enhance students' self-care abilities, while 88.9% noted improvements in healthy living awareness (HKFEW, 2017). Remarkably, 98% of schools indicated they would offer these subjects if adequate equipment and teaching staff were available.

To address these issues, this paper proposes integrating Virtual Reality (VR) as an innovative pedagogical tool within the Food Science and Technology strand of Hong Kong's T&L curriculum. VR could provide students with foundational exposure to kitchen environments and equipment before engaging in actual practice, potentially serving as a preparatory tool. Gamified learning has been widely recognized for enhancing student motivation, engagement, and knowledge retention. Recent research by Gordillo et al. (2022) demonstrated that students learning through educational video games achieved significantly higher learning gains and motivation compared to video-based learning.

VR games extend gamified learning possibilities by providing immersive three-dimensional environments, haptic feedback, and embodied interaction that closely mimics real kitchen experiences. This creates safe, controlled environments where students can practice culinary techniques without physical risks, effectively addressing both hardware limitations of inadequate facilities and software constraints of insufficient trained personnel. VR eliminates safety concerns, provides access for schools without cookery facilities, and minimizes preparation and cleanup time while offering personalized feedback and adaptive learning pathways.

The subsequent sections will review literature on gamified learning, explore VR integration advantages in Food Science and Technology education, and investigate how VR-based learning might enhance practical competency while addressing Hong Kong's documented hardware and software challenges.

2. Literature Review

Traditional food science and technology education faces significant systemic challenges that impede effective instruction delivery. In New Zealand schools, practical food-based education encounters substantial barriers including inadequate cooking facilities, persistent teacher shortages, and prohibitive infrastructure costs (Gorman et al., 2022). The cost of providing and maintaining cooking facilities is significant, with many facilities experiencing limited utilization of approximately 20 hours weekly, creating economic inefficiencies for educational institutions. The Hong Kong context presents additional complexities, with the Technology and Living curriculum encompassing diverse domains beyond food science, making it challenging to assess students' specific cooking abilities accurately (Gorman et al., 2022).

The evolution of food science education methodologies has progressed from traditional paper-based questionnaires to computer and mobile device-supported instruction (Gere et al., 2021). However, significant pedagogical challenges persist, including various cognitive biases that can influence student responses, such as acquiescence bias, demand characteristic bias, extreme responding bias, and desirability bias, all of which can compromise the validity of educational assessments and learning outcomes.

Extensive research demonstrates the substantial potential of gamification to enhance educational outcomes across diverse academic contexts. A comprehensive meta-analysis by Li, Ma and Shi (2023) involving 41 studies with 49 independent samples and over 5,071 participants revealed a significant large effect size ($g = 0.822$ [0.567 to 1.078]) for gamification's impact on student learning outcomes. The effectiveness of gamified learning varies considerably based on several key moderating factors, with elementary school learners and higher education users showing significantly larger effect sizes compared to secondary school users. Educational discipline also plays a crucial role, with science education showing the strongest effect size, followed by mathematics, engineering/computing, social science, and business (Li, Ma and Shi, 2023).

Design principles for educational gamification significantly influence learning outcomes, with the combination of "mechanics + dynamics + aesthetics" producing the largest effect size (Hedges' $g = 1.285$). This aligns with the MDA framework, which emphasizes the cohesive interplay between quantifiable game components, behavioural interactions over time, and emotional responses in generating successful learning outcomes. Food-related gamification research, while more limited, demonstrates similar positive trends across marketing, nutritional education, and healthcare applications, though research predominantly presents short-term empirical results with limited evidence of long-term effectiveness (Könnölä et al., 2016).

Virtual Reality technology offers unique affordances that distinguish it from traditional digital learning approaches. Gere et al. (2021) define VR as computer-generated stimulation creating immersive environments where users experience and interact as if in real-world situations. VR applications in food science demonstrate strong validity compared to real-life scenarios, with validation studies revealing significant correlations between VR and real-life consumer behaviours ($r = 0.91$, $P < 0.001$). VR environments enable manipulation of visual features without changing product composition, allowing for controlled experimentation with variables such as color, texture, and environmental context. Gorman et al. (2022) demonstrated VR's practical application in food technology education through a custom-developed VR Classroom, achieving a System Usability Scale score of 80.4 and high student engagement levels.

Comparative research examining video-based and game-based learning approaches employs sophisticated experimental designs to isolate the specific effects of different instructional modalities. Gordillo, López-Fernández and Tovar (2022) implemented a quasi-experimental design with 180 software engineering students, comparing video-based learning with teacher-authored educational video games. Their study revealed statistically significant differences in learning gains (p -value = 0.04, $r = 0.13$), with game-based learning proving more effective than video-based learning for both knowledge acquisition and motivation. Students in the experimental group rated the game-based learning experience significantly higher for motivation, fun, and overall opinion. Similarly, Gorman et al. (2022) employed user observation with questionnaire data collection from 12 middle school students, providing comprehensive assessment of both usability and educational effectiveness. The convergence of findings across these methodologically diverse studies provides robust evidence supporting the superiority of game-based approaches over traditional video-based instruction, particularly when enhanced through immersive technologies such as VR.

3. Methodology

This study aims to explore whether immersive VR experiences can enhance effectiveness in learning practical cookery skills compared to video-based instruction. The research employed a quasi-experimental design with control and experimental groups and pre- and post-tests to investigate the potential benefits of VR-based gamified learning in Food Science and Technology education. The methodology encompasses four key components: an overview of the research approach, detailed VR game design rationale, experimental procedures, and assessment methods.

3.1 Research Approach Overview

The research experiment was structured into three phases: a pre-experiment assessment, the experimental intervention, and a post-experiment evaluation. Students were randomly assigned to two groups - one engaging with a custom VR cooking game and another viewing video recordings of the same content. This comparison was designed to isolate the specific effects of VR's immersive and interactive features while controlling for content delivery.

Rationale for Video-Based Control Group: Video-based instruction was selected as the control condition for several practical and methodological reasons. First, video instruction offers standardized content delivery that is easily consumable and does not require specialized technical skills from participants, eliminating potential confounding variables related to technology familiarity. Second, video-based learning is widely used in Hong Kong's educational system and represents a realistic alternative to VR implementation. Third, using video recordings of the same VR gameplay ensures identical content exposure between groups, allowing for direct comparison of delivery methods rather than content differences. While acknowledging that this approach does not represent traditional hands-on cooking instruction, it provides a controlled comparison to evaluate VR's unique interactive and immersive advantages over passive content consumption.

3.2 VR Game Design

3.2.1 Focus on eggs: Curriculum and educational rationale

The custom-developed "Food Science Academy VR" game centres on egg-based recipes, a choice supported by multiple educational and practical considerations. According to the Hong Kong Education Bureau's Technology and Living curriculum guidelines (2017), proteins are typically introduced at the junior secondary level as fundamental macronutrients requiring practical understanding. Eggs serve as an ideal vehicle for teaching protein science concepts due to their versatility and clear demonstration of protein coagulation, denaturation, and functional properties.

Review of existing culinary education resources reveals that eggs are consistently featured as foundational ingredients in entry-level cooking instruction. Professional cookery textbooks and educational programs typically begin with egg preparation due to the ingredient's accessibility, safety profile, and clear visual demonstration of cooking principles. Furthermore, eggs allow for diverse cooking methods - from simple boiling to complex emulsification - enabling progressive skill development within a single ingredient category.

3.2.2 Scaffolding structure: Educational theory and practical implementation

The game's instructional content is organized using a scaffolding structure aligned with established educational theory and practical cooking pedagogy. This progression follows Vygotsky's zone of proximal development principles, where each level builds upon previous knowledge while introducing manageable new challenges. The scaffolding approach is further supported by analysis of existing cookery curricula and professional culinary training programs, which consistently employ progressive difficulty structures.

The level progression reflects both educational scaffolding principles and practical cooking complexity:

- Tool complexity: Early levels use simple tools (water, basic heat) progressing to more complex equipment (whisks, multiple cooking methods)
- Technique difficulty: Starting with passive cooking (boiling) advancing to active manipulation (whisking, emulsification)
- Safety considerations: Beginning with low-risk water-based cooking before introducing oil-based frying methods
- Curriculum alignment: Matching Hong Kong T&L curriculum emphasis on food safety, with progression from safer to more complex preparation methods

3.3 Game Content and Level Design

The VR game provides an integrative and immersive experience, guiding students through the entire cooking process from ingredient selection at a virtual supermarket to hands-on food preparation. The game presents multiple ingredient choices, with immediate feedback and pop-up explanations when incorrect selections are made, promoting learning through trial and error. In the cooking phase, students interact with various kitchen tools and reference a virtual tablet containing recipes and food science information. The game supports real-time correction by allowing players to reset levels and receive reminders when mistakes occur. Leveraging VR's motion-capturing capabilities, the simulation mirrors real-life cooking actions such as pouring liquids and whisking.

The following table outlines the progression of levels, detailing the key food science knowledge points and corresponding cookery techniques addressed at each stage:

Table 1: Level Design Structure

Level and Dish Name	Food Science Knowledge	Cookery Knowledge
Level 0 - Hard Boiled Egg	Protein coagulation, Protein denaturation under heat	Boiling (cooking with water)
Level 1 - Steamed Egg	Protein coagulation, Protein denaturation under heat, Protein unfolding / link loosening	Steaming (cooking with water), beating eggs

Level and Dish Name	Food Science Knowledge	Cookery Knowledge
Level 2 - Sunny Side-up	Protein coagulation, Protein denaturation under heat, Maillard Reaction	Pan-frying (cooking with oil)
Level 3 - Souffle Pancake	Protein coagulation, Protein denaturation under heat, Foaming (using egg white as a lightening agent)	Whisking, sieving
Level 4 - Eggs Benedict	Protein coagulation, Protein denaturation under heat, Emulsification (in Hollandaise sauce)	Whisking, Boiling (cooking with water)
Level 5 - Scotch Eggs	Cooking temperature of different proteins	Pan-frying (cooking with oil), mincing

3.4 Experimental Procedures

3.4.1 Participants and setting

The experiment was conducted in early April at the Arts and Technology Education Centre (ATEC). Four Grade 7 (Secondary 1) students were randomly selected to participate, ensuring no selection bias. To maintain fairness, two students were assigned to the VR game group (experimental group), while the other two formed the video group (control group). The content delivered to both groups was standardized, with the video group watching pre-recorded gameplay footage of the VR cooking game, ensuring exposure to identical instructional material. The said video could be found [here](#)

Student Profiles:

- Student A: Grade C+, Test Medium: Game
- Student B: Grade C, Test Medium: Game
- Student C: Grade B+, Test Medium: Video
- Student D: Grade A-, Test Medium: Video

Student grades reflect prior school performance in written and practical T&L assessments. These grades serve as indicators of general aptitude, though the T&L curriculum encompasses diverse domains including needlework and sewing, so grades may not fully represent specific cooking abilities.

3.4.2 Three-Phase experimental design

Phase 1: Pre-Experiment Assessment

Each student participated in a semi-structured interview designed to: assess perceived and actual subject performance, determine appropriate content difficulty level using school grading as reference, and gather background information for qualitative analysis.

Phase 2: Experimental Intervention

- VR Game Group: Students played the VR cooking game, following the intended game flow and interacting with the virtual environment to learn cooking processes.
- Video Group: Students watched video recordings of the same gameplay, with instructions to actively take notes on important methods, techniques, and observations.

Phase 3: Post-Experiment Evaluation

Immediately after the learning intervention, all students completed:

Written Test: Questions directly aligned with knowledge points addressed in the game/video

Practical Test: Students prepared cloud eggs, involving egg white and yolk separation and specific cooking methods demonstrated in the instructional materials, allowing direct evaluation of skill transfer and knowledge retention.

- Evaluation and Results
- a) Methodology

The primary evaluation method involved **comparing written and practical test scores** between the VR game and video groups, supplemented by qualitative observation of students' behaviour, confidence, and procedural accuracy during the cooking task. For the practical assessment, each step will be scored on a scale from 0 to 2: a score of 0 indicates the student was unable to complete the step correctly or performed with major mistakes, 1 reflects successful completion with minor mistakes, and 2 reflects the step was executed in a flawless manner.

- b) Experiment Results
- VR Game Group (Students A & B):

Table 2: Score of the VR Game Group students

Practical Test – Procedural Item:	Score:		Interpretation:	Other observations:
	A	B		
Pre heat oven to 230 °C	2	2	Both students had no trouble choosing the correct temperature	
Crack eggs and separate egg yolk and egg white	1	2	Student A broke the yolk when cracking the egg.	
Whip egg whites until stiff peaks are seen	2	1	Student B has trouble observing “stiff peak”, has tried to proceed to the next step even there the egg white is not whipped well.	Student B has asked numerous times whether the egg white is beaten well.
Add salt and pepper into the egg white	2	2	No issue.	
Put parchment paper on backing tray and pour egg white onto the parchment paper	2	2	No issue	Both students were observed making a small dimple in the egg white for the yolk in the later step, despite not being indicated in the recipe
Bake for 8 minutes, or until the egg white appears golden brown	1	1	Both students nearly burned the egg white because they placed the baking tray on the top rack of the oven, where higher heat led to faster cooking.	Both students have paid close attention to the egg white, and have asked if it is normal for the egg white to appear a bit burnt.
Put egg yolk on top and bake for 3 more minutes	2	2	No issue	
Practical Test Total	12/14	12/14	/	/
Written Test	6.5/10	7/10	/	/
Total Score:	18.5/24	19/24	/	Both students demonstrated carefulness and attention to detail during the experiment, as evidenced by their frequent checks to the recipe.

- Video Group (Students C & D):

Table 3: Score of the VR Game Group students

Practical Test – Procedural Item:	Score:		Interpretation:	Other observations:
	C	D		
Pre heat oven to 230 °C	2	2	Both students have chosen the correct degree without issue.	
Crack eggs and separate egg yolk and egg white	1	0	Both students broke the egg yolk repeatedly. Student D incorrectly transferred the egg white to the small bowl.	Student D has redo step 2 after she realised she has put the egg white onto the wrong bowl
Whip egg whites until stiff peaks are seen	1	2	Due to insufficient whipping, Student C's egg white remained semi-liquid	
Add salt and pepper into the egg white	2	2	No issue.	
Put parchment paper on backing tray and pour egg white onto the parchment paper	1	2	Due to the mishap in step 3, Student C's egg white does not set firmly on the parchment paper	
Bake for 8 minutes, or until the egg white appears golden brown	1	1	Both students nearly burned the egg white because they placed the baking tray on the top rack of the oven, where higher heat led to faster cooking.	
Put egg yolk on top and bake for 3 more minutes	1	1	Both students' egg yolk fell on the parchment paper during baking.	
Practical Test Total	9/14	10/14	/	/
Written Test	1/10	1/10	/	/
Total Score:	10/24	11/24	/	

- c) Qualitative Analysis

The **VR game group** showed superior retention and application of both procedural and conceptual knowledge. The immersive, interactive experience appears to have facilitated better visualization and memory of the steps, as well as increased self-efficacy during practical execution. In contrast, the **video group** struggled to translate passive observation into practical skills, suggesting limitations in engagement and cognitive processing when learning solely through video.

Notably, the issues experienced by the video group did not stem from the content itself (which was identical) but rather from the **method of delivery**; passive video watching may have resulted in lower engagement and less effective encoding of procedural knowledge.

4. Discussions

- Control Condition Limitations and Implications

The most significant limitation of this study concerns the control condition design. Using video recordings of the VR game as a comparison does not represent traditional Food Science and Technology teaching practices in

Hong Kong schools, which typically involve direct instruction, demonstration, and supervised hands-on practice when resources permit. This artificial control condition essentially compared active VR engagement with passive video observation of the same content, making it unsurprising that the VR group outperformed. A more valid experimental design would have compared VR instruction with actual classroom teaching methods currently employed in Hong Kong schools. The absence of such comparison severely limits the transferability of findings and prevents meaningful conclusions about VR's effectiveness relative to existing pedagogical practices.

- VR's Unique Contributions versus Digital Games

While the VR group demonstrated superior performance, it remains unclear whether these benefits stem from VR's unique affordances or simply from active gameplay versus passive viewing. The scaffolding structure and real-time feedback highlighted in our findings are features common to many digital games, not exclusive to VR (Gorman et al., 2022). However, certain patterns emerged suggesting VR-specific advantages: students in the VR group demonstrated better spatial understanding of cooking processes (evidenced by creating dimples for egg yolks without instruction) and more accurate replication of hand movements. These observations align with literature suggesting VR's three-dimensional visualization and embodied interaction provide unique benefits for procedural learning (Tusher et al., 2024).

Nevertheless, this raises a critical question: could similar results be achieved with well-designed non-VR digital games at lower cost? Future research must isolate VR-specific features—such as depth perception, natural hand tracking, and spatial presence—to determine whether these justify the substantial resource investment required.

- Resource Paradox and Implementation Feasibility

This study presents an inherent paradox: proposing VR technology as a solution to resource constraints in Hong Kong schools, when VR itself demands significant technological infrastructure. With documented teacher shortages and absence of standardized textbooks in Technology and Living education (InMedia HK, 2023), introducing resource-intensive VR systems may seem counterintuitive. However, several factors could mitigate this concern:

1. Centralized resource model: VR equipment could be shared across multiple schools through education centers like ATEC, similar to existing arrangements for specialized facilities
2. Scalability: Once developed, VR content can be replicated indefinitely without consumable materials, unlike traditional cooking practice
3. Safety and supervision efficiency: One teacher can safely supervise more students in VR than in actual kitchens, partially addressing teacher shortage issues

Still, the practical feasibility of widespread VR implementation in Hong Kong's educational context remains questionable without substantial policy support and funding allocation.

- Patterns in Learning Outcomes

Analysis of performance differences reveals interesting patterns beyond simple score comparisons. The dramatic disparity in written test scores (VR group: 6.5-7/10; video group: 1/10) suggests VR may particularly enhance theoretical knowledge retention, possibly through the integration of pop-up explanations and immediate corrective feedback during gameplay. Conversely, practical test scores showed smaller differences, with both groups making similar errors (e.g., incorrect oven rack placement), indicating that certain tacit knowledge aspects of cooking may not transfer effectively through either medium.

The video group's difficulty translating observed procedures into practice—particularly Student C's semi-liquid egg whites and Student D's bowl confusion—suggests passive observation fails to build the procedural schemas necessary for practical execution. VR's requirement for active decision-making and physical engagement may facilitate stronger motor-cognitive connections, though this hypothesis requires further investigation with larger samples.

- Artifact Design Considerations

The VR game's limitations, particularly simplified gesture controls and unrealistic liquid physics, highlight the tension between educational objectives and technical feasibility. While features like scaffolded learning and curriculum alignment represent good educational design applicable to any digital platform, VR-specific elements like spatial manipulation and embodied interaction were underdeveloped due to technical constraints. This raises important questions about the minimum fidelity required for effective VR-based skill transfer. Future

iterations must balance realism with computational efficiency and development costs, potentially focusing on aspects where high fidelity most impacts learning outcomes.

5. Conclusion and Future Works

- Conclusion

This study has explored the integration of a VR-based gamified learning environment into the Food Science and Technology curriculum at the junior secondary level, evaluating its effectiveness in enhancing students' practical cookery skills and theoretical understanding compared to traditional video-based instruction. The findings tentatively support the notion that the VR game can foster improved procedural competency, engagement, and knowledge retention. Students in the VR group, despite initially expressing low confidence and limited cooking experience, generally demonstrated higher performance in both practical and written assessments. The immersive and interactive features of the VR game, such as real-time feedback and a scaffolding structure, appear to have contributed to these positive learning outcomes.

However, several limitations must be acknowledged. The experimental design was preliminary and qualitative in nature, with a small sample size and possible selection bias, limiting the generalizability of the results. The pre-assessment relied primarily on self-reported aptitude rather than objective, quantifiable measures, and thus did not provide a robust baseline for comparison. Additionally, some students' unfamiliarity with kitchen equipment, as well as the limitations of both the VR simulation (e.g., gesture realism and physics effects) and the video-based approach (e.g., lack of negative examples and passive learning), may have influenced the outcomes. These factors highlight the need for a more comprehensive and rigorous evaluation framework in future investigations.

- Future Works

Future research should aim to address the methodological and design limitations identified in this study. Specifically, it is recommended to:

- **Develop Stronger Pre- and Post-Assessment Tools:** Implement standardized, skills-based assessments and objective performance metrics to accurately measure learning gains and provide a reliable framework for comparing pre- and post-intervention results.
- **Expand Sample Size and Diversity:** Involve a larger and more diverse group of participants to enhance the robustness and generalizability of findings.
- **Enhance VR Artifact Realism:** Refine the VR simulation to better replicate real-world cooking gestures, equipment operation, and food physics (e.g., effects of viscosity and liquid handling), thus improving immersion and authenticity.
- **Iterative Design Based on Feedback:** Incorporate ongoing feedback from both teachers and students to iteratively improve the educational content, realism, and usability of the VR game.
- **Address Passive Learning in Video-Based Approaches:** Redesign the video intervention to include negative scenarios or common mistakes, and provide opportunities for active engagement or self-correction, thereby enhancing its instructional value.
- **Investigate Long-term Impact:** Conduct longitudinal studies to examine the sustained effects of VR-based cookery training on student confidence, engagement, and real-life application of practical skills.

By addressing these areas, future work can contribute clearer evidence for the effectiveness of immersive technologies in practical skill development and provide actionable guidance for the integration of VR and gamified learning into Food Science and Technology education.

Ethics Declaration: I declare that this research has undergone official and proper ethics declaration from the authors' university (The Hong Kong Polytechnic University). Moreover, the work in this report is my own work. No part of this assignment is taken from other people's work and/or other sources without giving them credit. All references have been clearly cited.

AI Declaration: I declare that Generative AI tools have not been used to produce the submitted work.

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