Article

Incorporating Multimedia Teaching Methods and Computational Thinking into the Baking Dessert Course

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Abstract: Rapid developments in motion media technology have prompted the dessert industry to incorporate both motion multimedia and social media into their marketing strategies. Modern consumption patterns have shifted dramatically toward motion multimedia, with data searching and cost-related decision-making gradually becoming a new type of consumption experience. As a result, the effective application of motion multimedia and computational thinking has become a critical skill in culinary education, as it improves students’ learning outcomes and enables them to enter the workforce with a practical modern skill. This study examines the learning outcomes of Chinese Culture University students enrolled in a dessert-making course that experimentally incorporated motion media and computational thinking into its curriculum. The results show that this approach significantly enhances students’ learning outcomes, especially in terms of creativity and teamwork, both of which are critical in dessert-making. This study makes a strong contribution to the literature by demonstrating that motion multimedia-based teaching methods and computational thinking boost learning outcomes in dessert-making education.

Keywords: motion multimedia; computational thinking; dessert-making course; learning outcomes

1. Introduction

1.1. Motivations

Advancements in both technologies and business models have made many curricula outdated, meaning that they no longer meet the needs of their industry. Another modern educational challenge is the fact that courses rarely pursue knowledge internalization; for this reason, students struggle to put their knowledge into practice, contributing to the theory–practice gap [1–3]. In light of the evolving professional needs of the food and beverage industry, Jiang and Alexakis (2017) summarize the reasons why current curricula do not effectively serve the industry as follows: 1. Employees must be equipped with multidisciplinary skills and knowledge to align with new work modes. 2. Different companies and managers have different employee skill demands. In the modern era, with knowledge and needs evolving rapidly, the skills that students graduate with are often insufficient for meeting industry demands [4].

Furthermore, rapid developments in digital technologies have pushed marketing models in the food and beverage industry toward social media, web-based marketing and other online tools. Modern consumption patterns and processes are now fundamentally based on social media, with data searching and cost-related decision-making gradually becoming a new type of consumption experience [5–7]. As a result, the effective application...
of motion media and computational thinking has become a critical skill in the food and beverage industry, with service innovation becoming increasingly important [8,9].

Previous studies have shown that the incorporation of media-based teaching into courses enhances students’ learning comprehension [10–12]. Importantly, computational thinking can be learned by students regardless of age or discipline [13]. The problem-solving skills and methods that are developed through computer science are often viewed as generalizable and applicable to various other disciplines, making it a key field of study [14]. In fact, there is evidence that computational thinking-based educational methods significantly improve students’ learning outcomes [15]. The use of media (e.g., images, animations, videos, music) in teaching alongside vibrant, substantive content also boosts students’ motivation to learn in addition to creating unique, interesting learning experiences [16–19].

Garwood (2015) describes modern students as millennials who naturally embrace technology and prefer non-traditional teaching methods [20]. Thus, the adoption of technology-based learning and teaching tools strengthens the quality and satisfaction of students’ education [21]. Sanjeev and Birdie (2019) highlight several factors influencing the core competitiveness of the modern food and beverage industry: social media, innovative business models, and information technology [22]. All of these factors must be considered in the design of modern culinary curricula. Today, there are two pressing educational needs in Taiwan: the need to reduce the knowledge–practice gap and the need to develop the type of professionals required in the modern food and beverage industry. Employing media-based teaching in hospitality courses and, in turn, improving students’ multimedia skills constitute an important approach to the development of modern professionals in the food and beverage industry.

In this sense, the goal of hospitality education is not only for students’ and future employees’ professional knowledge but also for enabling them to apply technological knowledge, problem-solving skills and innovative practices [23]. Customers are often attracted to a dining establishment on account of the cook’s culinary skills, highlighting the importance of practical culinary skills [4]. This study incorporates motion media and computational thinking into a practical dessert-making course with the aim of aligning the course with modern multimedia trends in the food and beverage industry and, of course, enhancing the quality of the baked goods.

Based on the aforementioned research motivations, this study aims to design suitable course guidelines based on students’ learning outcomes after taking a dessert-making course featuring motion media and computational thinking. The results could serve as a benchmark for the design of courses that incorporate motion media and computational thinking and as a useful reference for culinary educators and food and beverage business owners. The purposes of this study are as follows:

1. To develop an experimental educational approach that incorporates motion media and computational thinking into a dessert-making course; and
2. To analyze students’ learning outcomes after taking a dessert-making course featuring motion media and computational thinking.

1.2. Literature Review
1.2.1. Theories of Scenario-Based Learning
1. Constructivism

Mattar (2018) defines constructivism as an educational theory that evolved from traditional philosophy and epistemology [24]. Constructivism maintains that knowledge exists in a purely subjective sense and is directly transmitted to learners. It stresses that knowledge transfer is not a passive, information-based process but rather an active process through which learners identify and solve problems. In this sense, learning constitutes an active, constructive behavior in the process of individual cognition.

Constructivism argues that students learn in a way that is based on their personal experiences; they acquire these experiences through the educationally meaningful activities in which they actively participate. After experiencing the more foundational elements of
education, learners construct a framework through which to integrate acquired knowledge. Learners must interpret the information they receive; they do not simply learn through direct knowledge transfer from their instructors [25–27].

2. Scaffolding

The “scaffolding” theory was coined by Wood, Bruner and Ross (1976) [28]. The theory suggests that learners’ growth, channeled through their intrinsic, psychological competence, is dependent on assistance from peers with stronger learning capacities. This assistance must be developed based on learners’ cognitive, organizational traits. The fundamental concept of scaffolding is based on a learning theory proposed by Russian psychologist Vygotsky, who asserted that the cognitive development of humans is a process of internalization—one of active transfer—in which social meanings and experiences are transformed into meaning within individuals. According to the scaffolding theory, the instructor provides temporary support, akin to the scaffolding used in construction, throughout the learning process; this scaffolding aids in the students’ independent, internal knowledge construction. Initially, students regulate themselves through social negotiation with others; as their learning capacity rises, responsibility is gradually shifted to the learner, and the scaffolding (e.g., guidance, assistance) is progressively removed. Ultimately, learners are able to engage in self-directed learning, constructing their own knowledge and achieving effective self-regulation [29].

Based on previous studies on the use of computing software as scaffolding, Reiser (2005) proposes two distinct types of scaffolding [30]. The first type structuralizes tasks to help learners complete learning tasks, reduce task complexity, provide various guidance methods and enable learners to focus on their goals. The second type provides various options from which learners can choose to address their own problems and dictate their own learning direction. The latter method enables learners to actively participate in the important processes related to their learning tasks, aiding in their cognitive development.

3. Situated learning theory

Situated design is an educational approach aimed at enhancing scenario-based learning. However, situational descriptions and contents in print instructional materials are mostly presented as images and text. Interactive media and online communication facilitate a virtual platform that enhances and activates the liveliness of instructional materials. Moghavvemi, Sulaiman, Jaafar and Kasem (2018) assert that, in addition to didacticism, teachers should implement a wide range of audiovisual, discussion-based and practical instructional activities to strengthen students’ attentiveness [31]. Brown, Collins and Duguid (1989) argue that knowledge construction can effectively be achieved through interactions between learners and their learning environment. Situated learning theory, the foundation of situated design, highlights the importance of learners’ interpretation, generation and application of knowledge in actual scenarios, as well as the way in which they integrate the scenarios into their social experiences [32]. Knowledge is inseparable from the social context in which it exists, yet learning can only be fully achieved through environmental interactions. In fact, situated learning theory stresses that, in actual social scenarios, learners acquire knowledge and skills but, more importantly, establish rationalized and meaningful interpretations of the acquired knowledge [33,34].

Lee et al. (2018)—in a quasi-experimental study based on the situated learning theory aimed at exploring empathy-based learning—show that the experimental group, which engaged in scenario-based learning, had stronger capacities for empathy-based learning [35]. This finding aligns with those of Moeller and Catalano (2015), who show that students experience significantly more effective knowledge and information transfer through situated contexts and experiences [36]. In a similar vein, the purpose of this study is to develop media-based instructional material for a dessert-making course in which lessons are transformed into immersive scenarios. This emphasis on media serves as a foundation for the development of inquiry-based teaching strategies.
1.2.2. Computational Thinking-Oriented Instruction of Visual Programming

Computational thinking was first proposed by Jeannette M. Wing, a computer expert at Carnegie Mellon University. She conceived computational thinking as a thinking model that utilizes the basic concepts of computer science to solve problems, design systems and understand human behavior [37]. The American Computer Science Teachers Association (CSTA) and the International Society for Technology in Education (ISTE) both identify computational thinking as a prerequisite skill for developing computer programs. Computational thinking can also be used to solve problems across all disciplines, including mathematics, science and the humanities. Computers can be used to generate thinking models aimed at solving various problems in life [38]. Bocconi et al. (2016) discuss how countries around the world emphasize the application of computational thinking in instruction, while scholars from various disciplines have proposed different opinions on the definition of computational thinking [39]. The National Academies of Sciences, Engineering and Medicine and the ISTE have all stressed the importance of computational thinking and the need to formally integrate it into education. Thus, this study integrates computational thinking into a practical course to aid in the development of students’ computational thinking skills. Through practice and the visual aid of media, students are expected to effectively utilize computational thinking and information technology to creatively solve problems, communicate and express themselves.

1.2.3. Motion Media-Based Teaching

According to Alberts and Stevenson (2017), “multimedia” materials are merely forms of media that combine two or more types of media to digitally exchange information or content [40]. Computers lie at the core of multimedia materials, as they can simultaneously present text, images, audio and animation. Students significantly improved their food-related knowledge, attitudes and intentions after receiving multimedia-based education. Traditional, text-based program design is largely rooted in abstract conceptions that are difficult to learn, resulting in low interest and even a fear of the topic among students [41]. Thus, visual programming languages have been specially designed to reduce the difficulty of learning programming. Kelleher and Pausch (2005) identify three common features of visual programming environments: a simplified program-design process, the provision of instructional material support to students and an emphasis on students’ learning motivations [42]. Selby and Wollard (2013) assert that program-design activities are associated with computational capabilities, as the process of learning programming enables students to develop holistic computational thinking skills, such as debugging, pattern recognition and abstraction [43].

Hsu and Chien (2015), having applied web-based multimedia technology to a culinary course, show that this approach enhances students’ culinary skills [44]. Malan and Leitner (2007) show that, when learning visual programming, students often perceive themselves to be playing a game rather than writing programs, enhancing their understanding of programming concepts [45]. The use of visual programming languages in education and block-based narrative programming enables students to progressively develop their thinking skills, avoid spelling and grammar errors, and concentrate on the logical and structural elements of program design [46]. In recent years, the ADDIE and ASSURE teaching models have been extensively used in the development of multimedia strategies in education. The models are described below:

1. Systemized ADDIE teaching model

According to Ismail et al. (2018), the ADDIE model primarily encompasses three concepts: what to learn, how to learn and how to determine that the student has achieved the desired learning outcomes [47]. ADDIE is an acronym covering five stages: Analysis, Design, Development, Implementation and Evaluation. Cox (2016) recommends that students should be exposed to teaching materials of varying degrees of difficulty and that teachers should consistently provide feedback, as this enables students to continually learn with a clear understanding of the topics at hand [48]. Teachers must use previous examples...
to stimulate learning among students and aid them in understanding concepts, scenarios or statuses that are difficult to explain in a straightforward manner.

2. ASSURE teaching model

The ASSURE model was proposed in 1982 by Heinich and Molend of Indiana University and Russell of Purdue University. This model of individualized, instructional design integrates information learning with audiovisual teaching methods. The ASSURE model integrates technology with teaching and focuses on using multimedia tools to aid teachers in achieving their educational objectives in actual teaching scenarios [49]. It is effectively a procedural guide that focuses on teachers’ means of implementing media tools in the classroom. ASSURE is an acronym covering six stages: analyzing students; stating objectives; selecting methods; utilizing media and teaching materials; requiring student participation; and evaluation and revision.

Based on this review of the literature, this study adopts a constructivist educational stance and employs both scaffolding theory and situational learning theory to demonstrate learning outcomes. This study analyzes the current state of baking education in Taiwan and develops a dessert-making course that integrates motion media and computational thinking. In turn, it examines the outcomes of this course approach. Finally, it offers pragmatic recommendations for educational approaches that would cultivate the culinary and baking skills needed in the modern food and beverage industry.

2. Materials and Methods

This study employs the quasi-experimental design teaching method. The study proceeds as follows. First, we analyzed studies on the introduction of motion media and computational thinking into practical dessert-making courses to identify relevant factors. Next, we validated the outcomes of implementing motion media and computational thinking through a one-group pre-test/post-test design in order to expand the application of relevant theories.

Quasi-Experimental Incorporation of Motion Media and Computational Thinking into a Dessert-Making Course

1. Participants and research setting

The participants of this study were students taking the Dessert Design course at Chinese Culture University. The scope of this study covered the curriculum of the Dessert Design course. The quasi-experimental teaching approach was conducted in the university’s baking classroom. Based on recommendations by Burger, Dohnal, Kathrada and Law (2001) and Narayan (2003) [50,51], the time series design in quasi-experimental teaching was used to arrange the participants’ curriculum. We only included a single experimental group. During the experiment, we collected a series of continual observational measurements (O) and performed an experimental treatment (T) at a specific time. We also engaged in variable adjustment. The objectives were: to examine whether significant changes occurred during the treatment (T) or at the time of the observational measurements (O1 and O2) taken before and after the variable adjustments; and to assess whether there were differences in the rate of change at different points. Ultimately, we were able to delineate the actual effects or time effects of the treatment (T) and variable adjustment. The experimental design is shown in Table 1.

<table>
<thead>
<tr>
<th>Course</th>
<th>Group</th>
<th>Pre-Test</th>
<th>Number of Students</th>
<th>Experimental Treatment</th>
<th>Post-Test</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dessert Design</td>
<td>Experimental</td>
<td>O1</td>
<td>50</td>
<td>T1</td>
<td>O2</td>
<td>50</td>
</tr>
</tbody>
</table>

Note: O1 indicates pre-test; O2 indicates post-test; T1 indicates experimental teaching for 18 weeks.
2. Research instruments

Before implementing the experimental approach to teaching, it is necessary to understand whether students are equipped with the intrinsic requirements for learning, such as the relevant knowledge, skills and expressive capacities. This is important in order to determine their starting behavior, which will serve as a useful reference point when analyzing the students’ outcomes and, in turn, designing future courses. To this end, this study revised the Motion Media and Computational Thinking Scale developed by Korkmaz, Çakir and Özden (2017) into a questionnaire that is more suitable to the context of our research [52]. The questionnaire measures the students’ knowledge about motion media and computational thinking and their learning outcomes after taking the dessert-making course. The items, which covered six dimensions, were measured on a five-point Likert scale. Based on a pre-test item analysis and expert validity testing, the scale boasts high reliability (Cronbach’s alpha = 0.822). The pre-test was administered to all participants during the first week of the experimental course, and the post-test was administered (with observations recorded) during the 18th week.

3. Course design

The experimental course was active for 18 weeks. The course, which incorporated motion media and computational thinking into dessert-making education, focused on students’ practical dessert-making skills and knowledge as well as their literacy and skills in motion media and computational thinking.

4. Microsoft Teams System

Microsoft Teams is a communication and collaboration software that integrates chat, video conferencing, file storage (including file collaboration), Office 365 and more. This research uses the video multimedia function and file collaboration function of the system.

5. Procedures

Each student taking the course is required to use Microsoft Teams to go online once a week (see Figure 1), during which time through the synchronous video and video sharing function of the Microsoft Teams system, each student who takes the online class can communicate with each other.

In addition, students in the course also produced videos of dessert products through the Macintosh’s iMovie software (see Figure 2). This is a video editing software from Apple that is popular for its simplicity, and most jobs can be done with a simple click and drag. It is an excellent tool for video organization, editing and sharing. It can achieve fast editing, precise editing and enjoyment of the clips made for each dessert in a fast and fun way. iMovie has rich special effects to make movies and to satisfy students’ use and learning of multimedia.

This research also uses Microsoft Excel Computational System to allow students to digitize the cost calculation and recipes of desserts; this is different from ordinary paper-based learning and deepens into a new vision of computational thinking and multimedia (see Figure 3).

6. Data analysis

We analyzed the recovered samples using SPSS, a prominent statistical software. We analyzed the participants’ basic data in terms of frequency distribution to achieve a preliminary understanding of the distribution of the sample structure. Additionally, we used one-way ANOVA to validate whether the experimental incorporation of motion media and computational thinking into a practical dessert-making course resulted in any significant differences.
In addition, students in the course also produced videos of dessert products through the Macintosh’s iMovie software (see Figure 2). This is a video editing software from Apple that is popular for its simplicity, and most jobs can be done with a simple click and drag. It is an excellent tool for video organization, editing and sharing. It can achieve fast editing, precise editing and enjoyment of the clips made for each dessert in a fast and fun way. iMovie has rich special effects to make movies and to satisfy students’ use and learning of multimedia.

This research also uses Microsoft Excel Computational System to allow students to digitize the cost calculation and recipes of desserts; this is different from ordinary paper-

Figure 1. Microsoft Teams System.

Figure 2. Videos for making dessert products.
3. Results

The main purpose of this study was to examine whether incorporating motion media and computational thinking into a practical dessert-making course results in significant differences in students’ learning outcomes and test performance. First, we conducted paired sample t-tests on the pre-test and post-test learning outcomes (those of a single group of students) to check for any significant difference in the students’ scores. We then used the mean pre-test score as a covariate in one-way ANCOVA and evaluated the differences between the mean total scale score and the following six sub-dimensions: “Techniques for digitizing motion media in dessert-making”; “Problem-solving skills in dessert-making”; “Teamwork in dessert-making”; “Creative thinking in dessert-making”; “Willingness to take a dessert-making course”; and “Motion media algorithm-design skills”.

3.1. Descriptive Statistics of Students’ Pre-Test and Post-Test Learning Outcomes

The descriptive statistics of the 40 students’ learning outcomes are summarized in Table 2. The average post-test score was higher than the average pre-test score across all six dimensions. This indicates widespread improvement. Interestingly, a comparison between the standard deviations show that intragroup variance was greater in the pre-test group than in the post-test group.

3.2. Analysis of Differences in Learning Outcomes

3.2.1. Paired Sample t-Tests of Students’ Pre-Test and Post-Test Learning Outcomes

The mean scores for the six sub-dimensions following the incorporation of motion media and computational thinking into the practical dessert-making course were calculated alongside paired-sample t-tests to check whether the pre-test and post-test scores were significantly different. The t-test results were as follows: techniques for digitizing motion media in dessert-making—\( t = -3.550, p = 0.022 (<0.05) \); problem-solving skills in dessert-making—\( t = -3.279, p = 0.000 (<0.001) \); teamwork in dessert-making—\( t = -2.841, p = 0.001 (<0.01) \); creative thinking in dessert-making—\( t = -4.681, p = 0.000 (<0.001) \); willingness to take a dessert-making course—\( t = -4.681, p = 0.000 (<0.001) \); and motion media algorithm-design skills—\( t = -4.112, p = 0.077 (>0.05) \). These results point to significant differences between the pre-test and post-test groups in terms of techniques for digitizing motion media in dessert-making, problem-solving skills in dessert-making, teamwork in dessert-making, creative thinking in dessert-making and willingness to take a dessert-making course.
course. In general, students exhibited better learning outcomes following the integration of motion media and computational thinking (see Table 3).

Table 2. Descriptive statistics of students’ learning outcomes.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Students</td>
<td>Mean</td>
</tr>
<tr>
<td>Techniques for digitizing motion media in dessert-making</td>
<td>40</td>
<td>5.23</td>
</tr>
<tr>
<td>Problem-solving skills in dessert-making</td>
<td>40</td>
<td>5.48</td>
</tr>
<tr>
<td>Teamwork in dessert-making</td>
<td>40</td>
<td>5.47</td>
</tr>
<tr>
<td>Creative thinking in dessert-making</td>
<td>40</td>
<td>5.24</td>
</tr>
<tr>
<td>Willingness to take a dessert-making course</td>
<td>40</td>
<td>5.03</td>
</tr>
<tr>
<td>Motion media algorithm-design skills</td>
<td>40</td>
<td>5.32</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>5.31</td>
</tr>
</tbody>
</table>

Table 3. Paired sample t-test results of students’ pre-test learning outcomes.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Group</th>
<th>Number of Students</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Mean</th>
<th>Standard Error</th>
<th>Correlation Coefficient</th>
<th>T-Statistic</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Techniques for digitizing motion media in dessert-making</td>
<td>Pre-test</td>
<td>40</td>
<td>5.23</td>
<td>1.06</td>
<td>0.168</td>
<td>0.057</td>
<td>0.361</td>
<td>-3.550</td>
<td>* 0.022</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>40</td>
<td>5.88</td>
<td>0.993</td>
<td>0.157</td>
<td>0.073</td>
<td>0.549</td>
<td>-3.279</td>
<td>*** 0.000</td>
</tr>
<tr>
<td>Problem-solving skills in dessert-making</td>
<td>Pre-test</td>
<td>40</td>
<td>5.48</td>
<td>0.893</td>
<td>0.141</td>
<td>0.054</td>
<td>0.653</td>
<td>-2.841</td>
<td>** 0.001</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>40</td>
<td>5.47</td>
<td>0.835</td>
<td>0.132</td>
<td>0.063</td>
<td>0.782</td>
<td>-4.681</td>
<td>*** 0.000</td>
</tr>
<tr>
<td>Teamwork in dessert-making</td>
<td>Pre-test</td>
<td>40</td>
<td>5.47</td>
<td>0.711</td>
<td>0.112</td>
<td>0.070</td>
<td>0.520</td>
<td>-2.841</td>
<td>** 0.001</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>40</td>
<td>5.82</td>
<td>0.752</td>
<td>0.119</td>
<td>0.075</td>
<td>0.782</td>
<td>-4.681</td>
<td>*** 0.000</td>
</tr>
<tr>
<td>Creative thinking in dessert-making</td>
<td>Pre-test</td>
<td>40</td>
<td>5.24</td>
<td>0.880</td>
<td>0.139</td>
<td>0.084</td>
<td>0.582</td>
<td>-4.681</td>
<td>*** 0.000</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>40</td>
<td>5.81</td>
<td>0.784</td>
<td>0.124</td>
<td>0.090</td>
<td>0.782</td>
<td>-4.681</td>
<td>*** 0.000</td>
</tr>
<tr>
<td>Willingness to take a dessert-making course</td>
<td>Pre-test</td>
<td>40</td>
<td>5.03</td>
<td>0.992</td>
<td>0.157</td>
<td>0.081</td>
<td>0.478</td>
<td>-3.071</td>
<td>** 0.002</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>40</td>
<td>5.51</td>
<td>0.949</td>
<td>0.150</td>
<td>0.083</td>
<td>0.283</td>
<td>-4.112</td>
<td>0.077</td>
</tr>
<tr>
<td>Motion media algorithm-design skills</td>
<td>Pre-test</td>
<td>40</td>
<td>5.32</td>
<td>0.834</td>
<td>0.132</td>
<td>0.087</td>
<td>0.283</td>
<td>-4.112</td>
<td>0.077</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>40</td>
<td>5.94</td>
<td>0.758</td>
<td>0.120</td>
<td>0.088</td>
<td>0.283</td>
<td>-4.112</td>
<td>0.077</td>
</tr>
</tbody>
</table>

Note: * p < 0.05, ** p < 0.01, *** p < 0.001

3.2.2. Single Factor Covariate Analysis

In the covariate analysis, the pre-test learning outcome score served as the covariate, while the post-test score served as the dependent variable. After excluding the influence of the pre-test results, this study examined whether there is a significant difference between the pre-test and post-test scores. Such a difference would indicate that the incorporation of motion media and computational thinking into the practical dessert-making course made a significant impact. As shown in Table 4, after excluding the effects of the covariate (pre-test score) and the dependent variable (post-test score), the F-value was 15.276 with a p-value of 0.000 and a significance level of 0.05. This points to a significant difference. After excluding the effects of the pre-test scores, the students’ post-test scores are shown to be significantly different on account of the experimental teaching method. The net effect size (eta-squared, \( \eta^2 \)) is 0.287, suggesting that the incorporation of motion media and computational thinking results in significantly different scores.
Table 4. Single factor ANCOVA results of students’ post-test scores following the introduction of computational thinking and motion media-based digital teaching in the practical dessert-making course.

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>III Sum of Squares</th>
<th>df</th>
<th>Mean Sum of Squares</th>
<th>F</th>
<th>Significance</th>
<th>Net Eta-Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revised model</td>
<td>5.472 *</td>
<td>1</td>
<td>5.472</td>
<td>15.276</td>
<td>0.000 *</td>
<td>0.287</td>
</tr>
<tr>
<td>Pre-test result</td>
<td>5.472</td>
<td>1</td>
<td>5.472</td>
<td>15.276</td>
<td>0.000 *</td>
<td>0.287</td>
</tr>
<tr>
<td>Error</td>
<td>13.613</td>
<td>38</td>
<td>0.358</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1374.628</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected total</td>
<td>19.085</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a \( R^2 = 0.287 \) (adjusted \( R^2 = 0.268 \)) * \( p < 0.05 \).

4. Discussion

4.1. Students Had Significantly Better Learning Outcomes after Taking the Course That Incorporated Situated Learning and Motion Media Relative to Traditional Education Methods

In constructivist education, teachers must associate situated learning with life scenarios and emphasize learner-centric instruction. Regular interactions and communication in teaching enable learners to engage in active learning, efficiently providing scaffolding to students. Providing assistance and guidance enables students to learn from their own experiences, meaning that they can independently construct meaningful knowledge, driven by nothing but internal motivations [26, 27]. Parkinson, Mackay, and Demecheleer (2018) show that, during the process of active learning, students come to understand industry-required skills through different learning methods [53]. They emphasize the importance of linking knowledge and meaning with actual scenarios. To this end, to assist students’ active learning, this study incorporated motion media and computational thinking into a practical dessert-making course; it enabled students to construct new knowledge models by utilizing the motion media-based digital teaching model in the context of situated learning. This approach is distinct from traditional lecture-based methods in practical dessert-making education, making it the main source of innovation in this study.

Our results show that students’ learning outcomes were significantly different following the implementation of situated learning. More specifically, the motion media-based teaching method resulted in better learning outcomes relative to traditional methods. This finding aligns with previous studies on computational thinking [54–57]. Evidently, the implementation of computational thinking-oriented course design, alongside a motion media-based teaching method, significantly enhances students’ learning outcomes in culinary education and restaurant management.

4.2. Students Had Significantly Better Learning Outcomes Following the Incorporation of Motion Media into a Practical Dessert-Making Course

Our results show that the integration of computational thinking effectively enhances students’ attentiveness. The course activities promoted active learning among the students, enabling them to develop thinking skills, to put their knowledge into practice, to articulate the reasons behind their decision and to utilize different modes of thinking to solve problems. These findings align with other studies that have found motion media to be conducive to students’ learning outcomes [18, 19, 34]. Epstein et al. (2020), for example, demonstrate the effectiveness of applying smartphones and videos to classroom settings [57]. The results of this study show that, via a focus on practical skills and situated learning, the integration of computational thinking with practical knowledge and practice-oriented competencies enables students to develop practical skills and enhances their self-teaching abilities.

Following the integration of a motion media-based teaching method in a practical dessert-making course, the most significant improvements in learning outcomes were, in order, as follows: “Problem-solving skills in dessert-making”; “Creative thinking in dessert-making”; “Willingness to take a dessert-making course”; “Problem-solving skills in dessert-making”; and “Techniques for digitizing motion media in dessert-making”. This study posits that, in traditional teaching, the theoretical and practical sides of “Problem-
solving skills in dessert-making” and “Creative thinking in dessert-making” are deeply interconnected, meaning that this approach to teaching is conducive to the timely application of various technologies and media to enhance learners’ understanding of actual scenarios. These technologies and media enable students to learn from their own actual experiences and, from them, to construct meaningful knowledge.

Futures thinking is regarded as a prerequisite skill for the educational systems of the future. Critical thinking and problem-solving through computational thinking are key to shifting from traditional teaching to a more insightful, modern approach [58]. Hershkovitz et al. (2019) show that computational thinking is correlated with creative thinking; students are more likely to succeed in creative thinking through a game-based approach [59]. The students in this study perceived their “Problem-solving skills in dessert-making” and “Creative thinking in dessert-making” as having improved the most over the duration of the course. This finding aligns with those of Dognhui (2021) [60]. Computational thinking not only aids students in expediting their understanding of digital information technologies but also advances their own professional competence, boosting their future work operations and managerial abilities.

5. Conclusions

Based on our results, the students perceived the incorporation of computational thinking and motion multimedia-based teaching methods into their dessert-making course as a novel teaching approach. Creativity constituted the biggest gain stemming from the novel approach. This is important, as high-end desserts are often critical factors in attracting customers to hospitality businesses, and the attractiveness of these desserts often relies on the dessert-maker’s creativity. An important objective across all fields in higher education is the development of students’ problem-analysis and problem-solving skills [61,62]. This study provides realistic, effective guidance for strengthening such skills among students. Additionally, the use of motion multimedia enhances students’ confidence and teachers’ instructional skills. Students were able to enhance their familiarity with the course material by readily associating newly acquired knowledge with previously held knowledge, in large part due to the use of motion media. Overall, the students were able to improve their problem-solving skills, acquire new knowledge and achieve greater learning outcomes.

This study introduced a dessert-design teaching model that incorporates computational thinking and motion media-based teaching methods to nurture and develop culinary talents in line with modern social and technological trends. The students were able to achieve the desired learning outcomes through the course and to achieve sustainability in culinary education. Cooperation is vital to the globalization of high-end dessert-design courses. Students not only need to learn professional knowledge about high-end dessert design, but they must also develop strong teamwork skills. Thus, learning in this field entails the development of cognition, conation and skills. The incorporation of computational thinking and motion media aids students in effectively internalizing the design process and improving their learning efficiency. Computational literacy not only expedites students’ comprehension of matters related to information technology but also enhances their own professional competence, which is essential in the digital age.

6. Contributions

This study made several contributions to the literature. Most importantly, it incorporated computational thinking-oriented course design and motion media-based teaching methods into a practical dessert-making course, overcoming the barriers traditionally faced by didactic approaches to teaching. This innovative educational integration strengthened students’ motion media skills, simulated their practical dessert-making skills and enabled them to identify their own weaknesses. As they developed their computational skills, teachers were also able to improve their teaching methods based on student progress.
7. Limitations

This study made several contributions to the literature. Most importantly, it merely investigated the integration of motion media-based digital teaching methods in a single course featuring a limited number of students. As this study employed the one-group pre-/post-test experimental design, there is no control group for comparison, restricting the interpretation of the results. Additionally, on account of time constraints, the developed syllabus did not allow for the addition of in-depth, motion media-based teaching, meaning that students were unable to advance their computational thinking skills during the course.

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