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ACADEMIC PAPER

The impact of creative culinary curriculum on creative culinary process and performance

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Abstract

This study has two goals: to analyse the impact of a creative culinary curriculum (3C) that emphasises teamwork on culinary arts students' creative process and creative performance, and to analyse the impact of the creative culinary (CC) process itself on CC performance. The study employed a quasi-experimental design, and the subjects were 43 undergraduate students majoring in hospitality management. The results were as follows: the CC process seems to have a limited impact on CC performance; however, after 3C-based instruction, the post-test scores were significantly higher than the pre-test scores for both CC process and CC performance.

Keywords: creative thinking; curriculum; process; performance

Introduction

The teaching of creativity in schools tends to involve two approaches. On the more abstract level, students may be taught problem-solving or brainstorming activities; on the concrete level there is the obvious need for hands-on training in a given creative discipline or art, followed by constant practice and development, whether one is learning to play the piano or to cook.

The culinary arts – which here include cooking, baking and others means of preparing dishes – are very special for, like certain crafts, they have a survival-based side as well as a cultural-aesthetic one. These two sides are in effect combined in the theatrical model (Horng

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& Lee, 2006), according to which the chef "performs in the kitchen" (Baum, 2006, p. 127). This performance in the kitchen combines the pragmatic knowing how to make the dish, the process of making the dish and the actual product, the dish that is made. Indeed, as in the fine arts, this knowledge, process and product may be considered holistic.

If we define the creative process as "the sequence of thoughts and actions that leads to truly creative production" (Lubart, 2001, p. 295), the prior knowledge and process of making might be taken together as creative process, and the actual product taken as a creative performance which makes use of and builds upon the earlier process(es). However, it is also possible to see the process as being the prior or potential knowledge or capacity and the performance as combining the process of making (which builds upon the earlier mental processes) and the final product (Lubart, 2001). Given either model, to date there have been few explorations of the relationship between creative process and creative performance in the culinary arts. This study assumes at the outset that the culinary creative (CC) process includes any processes, or sub-processes, that go on in the mind of a creative (in this case, culinary) artist just before they actually begin to create the artwork (the culinary product), while CC performance is the actual process of creating that work or product.

If the creative process is taken as something that comes before creative performance then the question of pedagogy, of teaching creativity, naturally arises. This can also be seen as the distinction between teaching the creative process, on a more abstract and theoretical level, and teaching someone to do something concrete, for example, play the piano, paint or cook beautifully. Yet there are few existing studies of strategies for teaching creativity (process and/or performance) in the culinary arts. However, the need for such studies is clear, precisely because of the need for more culinary creativity, and thus for more effective pedagogies which emphasise such creativity (see, for example, Ferguson & Berger, 1985).

The work discussed in this article began with a basic assumption: that teaching CC process/performance in the best way will depend to a significant respect on the degree to which, and the manner in which, CC process correlates with CC performance. The study set out to develop and test a pedagogical method for teaching culinary creativity, one in which both process and performance would be emphasised and evaluated. Its goals were: to analyse the degree to which, during the course of an experimental teaching programme, creative process (independently measured) seemed to positively impact performance; and to judge the overall efficacy of this pedagogy, measured in terms of its impact on both process and performance.

Literature review

Creativity

Creativity in the decision-making process is of crucial importance for successful managers (O'Halloran & O'Halloran, 2001). Over the past two decades, many researchers have defined creativity in the management context in terms of the development of new ideas about products, practices, services or procedures, ideas that are potentially useful to the organisation in the short or long term (see, for example, Amabile, 1996). While the traditional "4Ps" definition of creativity emphasises the perspectives of person, process, product and place (Rhodes, 1961), researchers have recently begun to interpret creativity in more holistic, dynamic and multidimensional terms. There is also a greater awareness that major breakthroughs tend to be the cumulative effect of incremental adaptations in procedures.

Creative culinary process

The nature of the creative process, taken as that sequence of thoughts which leads to truly creative production, has been one of the key subjects of creativity research during the past century. A general tendency of more recent creative-process models is their greater emphasis on the sub-processes: dynamic models allow for (re)cycling between and among these sub-processes, now deemed a necessary feature of creative problem-solving behaviour (see, for example, Horng & Hu, 2007a, 2008). As for the development of more synthesising theories, there has also been research on complex processes such as those of

articulation, analogy and metaphor, remote association, emotional resonance and feature mapping (Lubart, 2001, p. 299).

In 1926, Wallas proposed that the creative process had four phases: preparation, incubation, inspiration and evaluation. This classic model eventually led to a more extensive investigation of the processes of problem finding, problem formulation and problem redefinition (see, for example, Reiter-Palmon, Mumford, O'Connor Boes, & Runco, 1997). Then, in 1992, Finke, Ward and Smith advanced the geneplore model. This model consisted of two distinct processing components: generative processes and exploratory processes (Finke et al., 1992). According to this model, creativity involves both generative and exploratory processes. These two sets of processes are combined together in cyclical sequences that lead to creative products. The generative processes concern the construction of loosely formulated ideas called preinventive structures. Generative processes include knowledge retrieval, idea association, synthesis, transformation and analogical transfer. Exploratory processes include interpretation of preinventive structures, hypothesis testing and searching for limitations. Other theories of creativity have focused on the processes of idea generation, idea evaluation and problem solving (see, for example, Basadur, 1995). Influenced by both the Wallas and geneplore models, Horng and Lee (2006) identified the most significant personality traits shared by CC artists, and also found that personal culinary creativity is a result of the interaction between and among several factors, in particular personality, degree of motivation, way of thinking, and professional knowledge and experience. Horng and Hu (2008), also using a qualitative research method, constructed a dynamic model of the culinary creativity process that comprises several stages: preparing the idea, idea incubation, idea development and evaluation of the product.

Creative culinary performance

Creative performance, defined here as both the actual process of making a product and the final product itself, should be understood as the outcome of a complex interchange between individuals and their context (Scott & Bruce, 1994). Guastello, Shissler, Driscoll and Hyde (1998) found that the potential for creative performance was greatest in "people who engaged in a wide repertoire of cognitive styles" (p. 77). Most previous studies have measured observable (that is, performed) creativity using ratings provided by other individuals, and some laboratory studies have used the consensual assessment technique (CAT) (Amabile, 1996) in which two or more expert judges rate the overall creativity of each solution or product generated by a research participant. Such an approach allows for an evaluation of reliability of inter-judge creativity ratings: if there is an acceptable level of reliability, a creativity score is computed as an average of the creativity ratings for each participant across their generated solutions and/or creative products (Shalley & Perry-Smith, 2001). Employing the CAT, Horng and Hu (2007b) explored the relationship between the CC process and the actual performance of the culinary artist. They developed a path model of the relationship between process and performance.

Creativity and pedagogy

According to Maher (2004), encouraging creativity through specified learning outcomes may enhance the educational process for UK university students in the hospitality field. Morgan (2004) emphasised that students in this field need to develop self-awareness and motivation, imagination and creativity. They should also learn to think critically about the future of the industry. Fasko's (2001) studies point to a positive correlation between creativity and actual learning. Baer (2003) suggested that the core knowledge curriculum, with its detailed, specific content requirements for each grade level, may have a positive impact on students' creative performance in some areas. Most experts seem to agree that creative thinking is always driven by a problem and the need to solve it, and the research that has most influenced us falls back on theories of learning to contextualise or clarify this problem–solution relationship.

Virtually all studies in this area agree that a curriculum for teaching creativity must include a variety of creative thinking tasks. Some scholars have noted that improving students' creative thinking and problem-solving abilities, and cultivating an awareness of their own creativity, which may be two different things, are equally important educational goals (Kivela & Kivela,

2005). In addition to specific creative thinking or problem-solving tasks, there are creativity enrichment programmes, and some studies have demonstrated the positive impact of these programmes on students (see, for example, Camp, 1994). In a more concretely focused project, Fleith, Renzulli, and Westberg (2002) found that creativity programmes improved students' divergent thinking abilities.

Many researchers agree that students who learn in an environment of mutual respect and acceptance between and among fellow students and teachers will be more likely to increase their creativity (see, for example, Kivela & Kivela, 2005). Therefore, work has been done on developing a theoretical framework for teaching creativity. One of the basic principles is that the teacher must be creative and open-minded. If teachers enact classroom practices, policies and procedures that are supportive of creative expression, students will be more willing to take the intellectual risks necessary to express their creativity (Beghetto, 2005).

Positive impact of creative process on performance

Several studies have explored the role of the creative process in stimulating creative performance or production (see, for example, Tierney & Farmer, 2004). Parnes and Noller (1972) found that students who completed a sequence of creativity courses significantly outperformed comparable control students in respect to aspects such as fluency, flexibility and the capacity for reflecting on one's own ideas. Nemiro (1997) examined the creative process of actors, linking general preparation, rehearsal and performance activities to the stages described in Amabile's (1996) model. Lubart (2001) argued that certain process sequences and/or sub-processes would lead to a highly creative product, and that a great number of other possible sequences and/or sub-processes would lead to less creative (or even non-creative) productions.

Hypotheses

The present study begins from a conception of the creative process that draws on dynamic recycling of sub-processes models, and also assumes a connection between the creative process and the learning process, as discussed in the introduction to this paper. In its design of an experimental culinary creativity curriculum, this study was also influenced by those classroom learning theories which emphasise group interaction. The study's overall goal was to show that curricula specifically designed to teach creativity can enhance students' creative process and creative performance.

Hypothesis 1: The proposed curriculum experiment (teaching culinary arts with an experimental curriculum) will have a significantly positive impact on the subjects' (young culinary arts students') CC process.

Hypothesis 2: The CC process, including many of its sub-processes, is positively correlated with CC performance.

Hypothesis 3: The curriculum experiment will have a significantly positive impact on the subjects' creative performance.

The researchers also wanted to analyse, via the curriculum experiment, students' creativity (measured empirically in terms of a series of factors) of the sub-processes of both the creative process and creative performance. In this way they wanted to analyse the overall creativity of both process and performance. This study will therefore also posit that:

Hypothesis 4: Specific phases or sub-processes of the CC process can predict specific phases or sub-processes of CC performance:

Hypothesis 4a: Phase 1 of the process (preparation) can predict creative performance.

Hypothesis 4b: Phase 2 of the process (incubation) can predict creative performance.

Hypothesis 4c: Phase 3 of the process (inspiration) can predict creative performance.

Hypothesis 4d: Phase 4 of the process (evaluation) can predict creative performance.

Methodology

This research project combined a quantitative method with a qualitative one. The research team first created an outline for a 3C: an elective 3-credit course, taught at two universities in Taiwan, as shown in Table 1. The curriculum design was congruent with the holistic, dynamic and multidimensional aspects (see, for example, Amabile, 1996). Based on the outline, a complete curriculum was developed which included an introduction to the nature of creativity, relevant creativity skills and a review of basic culinary skills, food cultures, chromatics and principles of food science. In this curriculum design, creativity, culinary knowledge and skills were integrated. Provision was made for both practice and performance, and for the use of books and articles, lectures, and multimedia instruction in the form of videos, music, interactive computer programmes, slides and photos of culinary works. This curriculum also employed a variety of teaching methods including group discussions, competitions, games and sensory evaluations, and creative thinking instruction strategies such as brainstorming. Thus the experimental curriculum would give participants the opportunity to integrate theories of culinary arts and creativity with practical creative thinking skills, and to engage in an individual and group practicum. This curriculum's validity was then reviewed by five experts in creative thinking education and the culinary arts.

Theme	Hours	Content
1. Creativity and culinary art	12	● the nature of creativity ● how to think creatively ● creativity and CC art
2. Nature of creative culinary works	8	● the meanings of CC works ● culture and culinary creativity ● multicultural exchanges and culinary creativity
3. Five senses and culinary creativity	12	● visual psychology (visual) ● colour (visual) ● style, decoration, and arrangement (visual) ● flavour, taste, and seasoning (smell, touch, and hearing) ● dining environment and atmosphere (touch) ● name of artwork (hearing)
4. Culinary skills and creativity	8	● selection of materials ● basic skills

Table 1: Outline of 3C

Following this, the intervention was implemented: an experimental group of senior undergraduate students were taught according to the newly designed curriculum. Participation was voluntary and students were rewarded with gift certificates according to their culinary performance. In order to measure the degree of each student's creativity, in other words their creative performance (or production) before and after the experiment, a quasi-experimental method was adopted. Quantitative data were collected by means of a questionnaire survey of the students.

Implementing a quasi-experimental pedagogy to developing creativity

The subjects, undergraduate seniors, had all taken a CC course in a department of hospitality management or culinary arts management in Taiwan. The experimental creativity class was taught by one teacher in each university and met once a week for a 4-hour session during the 16-week semester. Courses were considered parallel if the same course was taught at the same time (i.e., during the same term), had the same course content and used identical assessments. The instructors had over 10 years of teaching experience and participated in this project for 2 years. The design was quasi-experimental because participants were not randomly assigned to the conditions. Rather, the conditions were

determined based on participants attending courses in different universities. Comparisons were made over two measurement times between the intervention groups. Less than a quarter of the time was spent on lectures: the majority of class time was devoted to exercises, discussions and comprehensive performances.

The participants were 31 undergraduate students from National Penghu University's Department of Hospitality and 12 students who took the CC Arts course at National Kaohsiung Hospitality College's Department of Chinese Culinary Arts. Over half (62.8%) were female and 37.2% were male; most of them were majoring in Chinese cuisine (81.6%) and the rest in Western cuisine, Japanese cuisine and baking.

The researchers used SPSS 12.0 for their analysis: they employed descriptive analysis, correlation and a *t* test to determine significant differences between the pre and post-test results.

Measures

The researchers had already arrived at a general consensus that creativity involves the production of novel, useful products and suggested that measures of creative performance should, whenever possible, be referenced against reasonably realistic creative performance tasks (see, for example, Mumford, 2003). To measure the improvement in the participants' creativity performance, the teachers and other experts evaluated the culinary works at the end of the experimental class. Pre-tests and post-tests were carried out. The questionnaires used for each phase of data collection were composed of 40 criteria, drawn from the inventory for the CC process and based on idea preparation, idea incubation, idea development and verification of the new work's creativity (Horng & Hu, 2007a). The scale used for the different phases of the CC process included multiple items and showed acceptable internal inconsistencies. A 6-point Likert-type scale was used as the response format for all items. The participants were then asked to complete the CC process inventory twice: at the end of the second week (pre-test; t1) and the end of the sixteenth week (post-test; t2) of the semester.

The participants were required to create a new dish that somehow used chicken, and the CAT was used to assess their culinary products (Amabile, 1996). Based on previous research by Horng and Lin (in press) in which they used the CAT, 34 criteria were compiled in order to examine the subjects' CC performance. Two teachers and three additional experts rated students' culinary performance using the scale for CC performance, and the inter-rater agreement of the five experts' ratings of CC performance was found to be acceptable (effective reliability of judges = .79; see Rosenthal & Rosnow, 1991, p. 51–52.)

Qualitative research

The second part of this research project used qualitative data that was based on (a) class observation, (b) in-depth interviews with teachers and students, and (c) a study of students' handouts and teachers' reflection notes. The researchers collected extensive data to facilitate analysis. The concepts of themes were then inductively derived from an initial set of qualitative descriptions of interviews transcripts. When these were coded into rudimentary categories, they led to the collection of more descriptions. To guarantee the project's credibility, participants provided documents such as photographs, reflection notes and personal learning logs, so that the researchers could conduct triangulation analysis. Finally, the project's validity was further reinforced by the researchers' reflection notes: these were reflections on their research methodology and on the 3C programme's overall effectiveness.

Research results

Hypothesis testing

Hypotheses 1 and 3 suggested that there would be significant differences between the CC process and CC performance as measured before the experimental intervention and after it. In the inventory for the CC process, significant differences were found between and among

the overall scores (Table 2). The overall score for CC process (t = 5.42, p < .01) was also statistically significant, as were the scores for each of the sub-processes – preparing the idea (t = 3.89, p < .01), idea incubation (t = 2.86, p < .01), idea development (t = 3.37, p < .01) and evaluation of the product (t = 3.40, p< .01). Cronbach's alpha for the four sub-processes of the inventory for the CC process ranged from .83 to .94. This demonstrated that the participants' 4-phase CC process had been greatly strengthened or enhanced, supporting Hypothesis 1.

	Post-test		Pre-test		
Criteria	**M**	**SD**	**M**	**SD**	***t* value**
CC process					
Preparing the idea	35.32	5.55	31.21	5.71	3.89*
Idea incubation	44.36	3.67	39.73	6.72	2.86*
Idea development	83.00	10.00	75.67	12.70	3.37*
Evaluation of the product	24.33	2.23	22.17	3.10	3.40*
Total scale	46.75	5.36	44.08	7.06	3.27*
CC performance					
Professional technique	10.58	1.84	7.52	2.49	17.70*
Aroma, taste and texture	15.04	2.57	11.30	3.97	11.91*
Colour	11.17	4.06	8.22	2.78	9.78*
Modelling and arrangement	10.79	2.28	7.82	3.26	13.82*
Garnish	6.92	1.63	4.72	2.25	13.93*
Dishware	13.44	2.54	9.29	3.85	15.75*
Handling of ingredients	21.89	4.01	16.78	4.65	12.69*
Overall assessment	33.38	5.37	24.45	7.35	15.46*
Total scale	123.13	18.26	90.79	26.50	17.30*

Table 2: Pre and post-test results for CC performance, *p < .01

As for participants' CC performance (Table 2), all of the following were statistically significant: professional technique (t = 17.70, p < .05); aroma, test and texture (t = 11.91, p < .05); colour (t = 9.78, p < .05); modelling and arrangement (t = 13.82, p < .05); garnish (t = 13.93, p < .05); dishware (t = 15.75, p < .05); handling of ingredients (t = 12.69, p < .05); overall assessment (t = 15.46, p<.05); and overall score (t = 17.30, p<.05). The inter-judge reliability of the eight dimensions of CC performance ranged from .88 to .95. This implied that the participants showed significant progress in each dimension of CC performance, supporting Hypothesis 3.

Tables 3 and 4 present the means, standard deviations and correlations between the CC process and CC performance measures. Hypothesis 2 suggested that the CC process is positively correlated with CC performance. Surprisingly, however, most phases (sub-processes) of the CC process were not significantly correlated with the dimensions of CC performance. Only Phase 1 of the process – preparing the idea – was significantly related to a few of the CC performance dimensions, including aroma, taste and texture, modelling and arrangement, and garnish. Thus Hypothesis 2 was not supported.

Variable	Mean	SD
1. IP	35.32	5.55
2. II	44.36	3.67
3. ID	83.00	10.00
4. VCA	24.33	2.23
5. PT	10.58	1.84
6. ATT	15.04	2.57
7. C	11.17	4.06
8. MA	10.79	2.28
9. G	6.92	1.63
10.D	13.44	2.54
11.HI	21.89	4.01
12.OA	33.38	5.37

Table 3: Means and standard deviations
Variable coding: IP = idea preparation; II = idea incubation; ID = idea development; VCA = verification of culinary work; PT = professional technique; ATT = aroma, taste and texture; C = colour; MA = modelling and arrangement; G = garnish; D = dishware; HI = handling of ingredients; OA = overall assessment

Variable	1	2	3	4	5	6	7	8	9	10	11
1. IP											
2. II	.33										
3. ID	.39*	.30**									
4. VCA	.38*	.42**	.45**								
5. PT	.24	.24	.25	.15							
6. ATT	.63**	.12	.17	.08	.34**						
7. C	.20	-.15	-.09	-.15	.45**	.48**					
8. MA	.43*	.11	.06	-.05	.45**	.44**	.35**				
9. G	.46*	-.07	.12	.08	.59**	.58**	.25**	.41**			
10.D	.25	-.17	-.03	-.03	.45*	.32**	.46*	.55**	.58**		
11.HI	-.16	-.09	-.15	-.24	.56**	.32*	.35**	.48*	.37*	.20*	
12.OA	.12	.26	.06	.02	.74**	.54**	.64**	.55**	.46*	.33**	.68**

Table 4: Correlations among variables
Note: *p < .05; **p < .01; variable coding as in Table 3

Construct Variables	CC performance (*β*)								
	PT	ATT	C	MA	G	D	HI	OA	Total
Phase 1	.03	.26	.54*****	.09	.53*****	.09	-.03	.03	.07
Phase 2	-.09	.75******	.12	-.05	-.13	-.11	-.03	-.03	-.07
Phase 3	.00	-.08	-.13	.07	-.06	.03	.04	.09	.03
Phase 4	.19	.09	-.19	.07	.24	.19	.09	.02	.11
R^2_{adj}	-.08	.34	.08	-.08	.11	-.06	-.10	-.10	-.09
F	.27	3.97*	1.48	.26	1.67	.45	.10	.10	.21

Table 5: Results of regression analyses
Note: * p< .05; ** p< .01; variable coding as in Table 3

Hypothesis 4 was that all creative sub-processes (phases) predict positive CC performance. Regression results in Table 5 showed that only Phase 2 (incubation) predicted aroma, taste and texture (β = .75, p < .01), while Phase 1 (preparation) predicted colour and garnish (β = .54, p < .01; β = .53, p < .01; respectively), and that no phase predicted overall CC performance. Thus, it was concluded that the overall effects of CC process variables cannot predict overall CC performance. As for the specific effects of sub-processes on performance, Hypotheses 4a and 4b, asserting the positive impact on performance of preparation and incubation, were supported. However, Hypotheses 4c and 4d, asserting the positive impact on performance of inspiration and evaluation, were not supported.

Qualitative analysis

The qualitative findings provided further insight into various aspects of the creativity education programme, as well as into the characteristics of the school environment that influenced students' CC process and performance. It appeared that the implementation of the experimental curriculum had a direct positive impact on the development of students' CC abilities, that is, on both their creative process and creative performance.

As for the actual CC curriculum and different ways of implementing it, the teachers' reflection notes revealed one very important point, which was the need to allow time for creative thinking. The teachers also mentioned the need to implement the 3C programme in other courses, not just in culinary courses in hospitality. For instance, mind mapping could also be used in other courses as a way of reflecting on what had been learned more generally, not just for specific creativity courses:

> After introducing several kinds of creative techniques, students were asked to use the card method and to compose mind maps using concepts. Mind mapping seemed to have made a strong impression on them. From their discussions and exercises, I could clearly find that their imagination is so unlimited. I was very excited by the emergence of a series of unexpected associations. (Penghu teacher)

The CC programme contents include creativity and culinary arts theories, as well as practical applications where the creative exercises (or practices) emphasise students' individual and group creativity. The major objective of the new pedagogical strategies is to allow teachers to teach more efficiently and effectively, and enable students to actively participate in the process of their education. This study has adopted several creative thinking strategies for CC education. These strategies, designed to help students develop their ideas, elicit their responses and enhance their learning.

> I find integrating the different elements of dishes most interesting, followed by the recipe. For example, I find combining different slicing methods with different preparation methods interesting… and challenging. (Penghu student)

> I find the 'forced relationships strategy', or combining two items that are generally not placed together, very interesting. (Penghu teacher)

In the culinary arts the 3C educational method is different from traditional teaching methods, such as lecture and demonstration, and helps enhance interest in learning and creative motivation.

> This kind of study gives me a sense of achievement and stimulates my interest in learning. (Kaohiung student)

Fasko (2001) emphasised the use of divergent thinking to stimulate creativity. Through brainstorming, students are able to formulate original and unorthodox ideas. Furthermore, in culinary creativity education, small group interactions can be designed to stimulate brainstorming. Students propose ideas, discuss them with others, and give one another feedback and recommendations. This promotes more complete and better organised conceptualisations. Also, a learning environment filled with fun and games can create a more

positive and encouraging atmosphere. Moreover, to avoid obstacles to students' creativity, teachers should tolerate ambiguity and allow mistakes during their courses and practicum sessions.

> Not bad! The more cooking the better! After the cooking was done, everyone was happier because everything was more exquisite. For example, that main dish was not supposed to contain so many things, only fish paste, thin noodles and a cold squid dish. However, the side dishes are a topic for our discussions and arguments. (Penghu student)

Discussion

This study examined the positive effects of both the CC process and CC performance using the 3C experimental curriculum. All dimensions of the CC process and performance were strengthened and enhanced after the experimental intervention. This corresponds with the findings of previous studies on the effects of creativity education (Fleith et al., 2002). However, while the potential mechanisms through which the CC process might be expected to affect CC performance were analysed, data analysis showed that the CC process had only a partial effect on CC performance. This finding is congruent with the results of both Mumford Supinski, Baughman, Costanza, & Threlfall (1997) and Horng and Hu's (2007b) studies on the effects of creative process on creative performance. Thus, it may be appreciated that that the positive effect of CC process on CC performance is limited, even though the former remains a fundamental component of the latter.

Thus the researchers' failure to prove Hypothesis 2 is to a certain degree qualified. This can best be explained by looking at the sub-processes. Although the results suggest that sub-processes 3 and 4 do not have a clear positive impact on CC performance, they also show that, to a limited degree, sub-process 1 (idea preparation) and sub-process 2 (idea incubation) may lead to better CC performance. For instance, if someone intended to improve the colour and garnish of their product, they would need to emphasise idea preparation in particular; if they wanted to improve aroma, taste and texture, they would have to focus on idea incubation. From the fact that the CC process could only explain 13% of the variation in performance, the researchers concluded that there must be other important factors influencing CC performance (e.g., individual and contextual variables) since the culinary artists' complex psychological processes may be mediated or moderated by factors such as personality, intrinsic/extrinsic motivation, relationships with supervisors and a sense of psychological freedom (see, for example, Amabile, Conti, Lazenby, & Herron, 1996).

While the researchers cannot really pinpoint specific CC processes, it seems that the general emphasis on small-group interaction as the best method for teaching the 3C curriculum may be one of the main reasons why students were able to improve their CC performance during the course of this experimental intervention. The researchers know from the responses that students felt that this small-group interaction was very important to their creative development as culinary artists. In particular, the creativity lessons, in which creative thinking games were played in a friendly classroom atmosphere, seem to have contributed substantially to the success of the 3C programme. These results concur with the findings of studies on teaching techniques, learning environment and students' performance (Fleith et al., 2002).

The experimental students also seem to have greatly enjoyed learning (through books, websites, films and from one another) about the cultural backgrounds of international dishes, including the stories behind the various ingredients. For example, in order to teach the curriculum's local Penghu food and culture section, teachers created a special learning environment and encouraged small-group learning and information sharing. Students expanded on what they had learned about this culture in brainstorming sessions.

Conclusions

This research project aimed to design and explore the effects of a 3C which combined creativity theory, creative thinking, culture and the culinary arts. The quantitative and qualitative analyses have shown that, while the CC process seems to have a limited impact on CC performance, Phases 1 and 2 can predict the garnish, aroma, taste and texture of the finished product. Furthermore, independent of the issue of the possible effects of process on performance, both CC process and CC performance can be significantly improved by the teaching of culinary arts using the experimental 3C curriculum.

Furthermore, from the comments of those who taught this curriculum and from their reflection notes, as well as from students' interview responses and handouts, the researchers could easily observe the creative growth of individual students and of student groups or teams. Qualitative analyses strongly suggest the importance of keeping a free and open atmosphere in the classroom, and teaching students in small groups with a lot of peer interaction. In both cases, it is clear that students' motivation to learn as well as their creative thinking is more easily stimulated, and that they are more willing to try new and unfamiliar exercises and games. Interactive activities that are spontaneously played in small groups are quite different from the traditional pedagogical strategies of lecture and demonstration.

Given the obvious benefits of the 3C for the teaching of culinary arts, the researchers strongly recommend that culinary schools, institutes and departments implement it. It is also recommended that the 3C programme should be extended to become a 1-year programme in order to more substantially improve the CC performance of culinary arts students.

Results also show that the theoretical, practical and cultural–aesthetic components of this curriculum are all important. The theoretical and practical components include creativity theory and, based on this, the creative thinking exercises discussed above. The cultural–aesthetic components include culinary arts and culture, and also the role of the five senses in the culinary arts. The psychology of vision and of smell, touch and taste has been found to play a significant role. It also seems clear that one's own culture and social system are major components in shaping one's creative behaviour and performance. The researchers hypothesise that this is a significant reason why the CC process in itself, taken independently of social and cultural factors, exhibits only a moderately significant effect on CC performance.

Further reflection on the negligible relationship found in this study between CC process and CC performance has led the researchers to hypothesise that the main reason might be this: the experimental period (one semester) was not long enough to observe cognitive changes in some subjects' culinary creative process. This is a limitation of this research study. These subjects did not have time to develop their CC process to a level where it could predict CC performance. On the other hand, the teachers found that their students became more interested in facing problems and more competent in solving them. This may have been primarily a function of the small-group interaction teaching method. Moreover, all the data in this study were collected in Taiwan. Cross-cultural generalisability of the results may be a concern. Finally, the teachers as researchers in this study were, it could be argued, a strength and weakness (e.g., in relation to lack of objectivity of the process and preconceptions). Future research could address the diversity of curriculum and creativity.

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