

Kitchen KungFu: A Match-3 Game to Explore Chinese Medical Beliefs

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Abstract. Chinese people have their own set of medical beliefs. However, it could cause misunderstanding during cross-cultural communication, especially under clinical settings. In this case study, we designed an educational game *Kitchen KungFu*, which incorporates knowledge of Chinese medical beliefs into the rules of match-3 games like *Candy Crush Saga*. Specifically, the game presents yin-yang theory and the cold-hot foods culture. Ten international participants were recruited to play the game and give feedback. Quantitative and qualitative analyses showed that this educational game increased participants' agreement with and knowledge of Chinese medical beliefs. As an exploration of employing gamification to promote cross-cultural understanding, *Kitchen KungFu's* design and evaluation process could provide valuable reference for future studies.

Keywords: Cross-cultural communication · Chinese medical beliefs · Gamification · Educational game

1 Introduction

1.1 Chinese Medical Beliefs

Chinese people have their unique beliefs about healthcare and medicine. These medical beliefs are shaped by various factors. Among others, Traditional Chinese Medicine (TCM) plays an important role. For example, theories of Zang-fu (viscera) and Ching-lo (meridian), and theory of Chi (energy) constitute ancient people's understanding of human's physical structure [1]. Besides TCM, religions and philosophies also bring profound influence. For example, yin-yang theory and five-element theory, which are stemmed from Taoism, shape the basic logic of traditional Chinese medical system. Fatalism, which is advocated by Buddhism, could affect patients' response to certain diseases and medical treatments [2]. And Confucianism emphasizes family values and respect to doctors [3]. Meanwhile, some social and cultural customs like Fengshui and fortune-telling also have impact on people's medical beliefs and practices [4].

1.2 Cross-Cultural Communication

Even as western medicine is globally dominant, Chinese people still, to some extent, hold to their own medical beliefs. Undoubtedly this cultural uniqueness shapes

Chinese's cultural identity. However, it can also result in misunderstanding during cross-cultural communication, especially under clinical settings. For example, a western physician may not understand when his Chinese patient says he feels "numb" in his body, which is caused by inadequate "blood and energy" [5]. Or, due to Chinese's holistic view regarding body and mind as unitary, patients with mental illness like depression tend to describe their diseases as physical symptoms. In that situation, western doctors might fail to diagnose the true causes [6].

To avoid the trouble, some immigrants would choose Chinese clinicians or even return to home countries for medical treatment [5], which leads to inconvenience and further cultural isolation. Therefore, raising awareness on Chinese medical beliefs is a worthy effort to bridge the cultural gap.

Though introductory materials on Chinese medical beliefs are not rare, most of them are in the form of books and articles. On mobile platform, some applications featuring TCM are also available, for example, *Eastland Herb*, *Traditional Chinese Medicine* and *TCM Herbal Formula Library*. However, most of them are abbreviated versions of medical books or lists of diseases, cures and herbs, which lack interaction and entertainment. In order to address the gap, we designed an educational game called *Kitchen KungFu*, and evaluated its effect on changing player's level of agreement with and knowledge of Chinese medical beliefs.

2 Ideation

2.1 Theme

Among various Chinese medical beliefs, yin-yang theory is a core concept as well as the most influential one even among the highly westernized Chinese people [5]. It stems from Taoism, representing the balance between two opposite forces. In foods, yin-yang is demonstrated as their cold or hot properties. People take proper foods according to their own cold or hot "body constitution" to keep the balance [1]. Considering that food properly demonstrates the essence of Chinese medical beliefs, as well as stimulates people's interest, we employed it as our design's starting point.

2.2 Gamification

We decided to apply gamification to introduce Chinese medical beliefs because it could stimulate users' interest and convey knowledge at the same time. According to Deterding et al., gamification is using "game design elements in non-game contexts" [7]. Within the broad category of game, educational games are those designed to facilitate learning [8]. Using game elements in learning environment could increase players' incentives and interest, resulting in higher-level memorization and lasting influence [7, 9].

Among various game genres, we based our design on match-3 game, or matching tile game, whose core mechanics is to make and eliminate combos of three or more same items by swaping adjacent items. Such games include *Candy Crush Saga* and *Bejeweled*. The simplicity of match-3 game enables it to be easily played and spread

across different cultures [10]. Meanwhile, its “matching” nature provides a suitable base for us to add more complicated rules and demonstrate Chinese medical philosophy.

3 Kitchen KungFu

3.1 Prototype

The game is named as *Kitchen KungFu*, indicating that it is about both food and Chinese culture. A cartoon panda is designed as narrator, introducing background knowledge and rules. Overall, the game content consists of two sections: 1. cold and hot foods 2. food and body interaction. Within each section, there is one warm-up exercise where related concepts and theories are introduced. In the first section warm-up, players learn about yin-yang theory and cold-hot foods, and anticipate the category of some common foods (shown in Fig. 1). In the second section, players complete a simple quiz to determine their body constitution, and then learn about the relationship between body and foods (shown in Fig. 2).

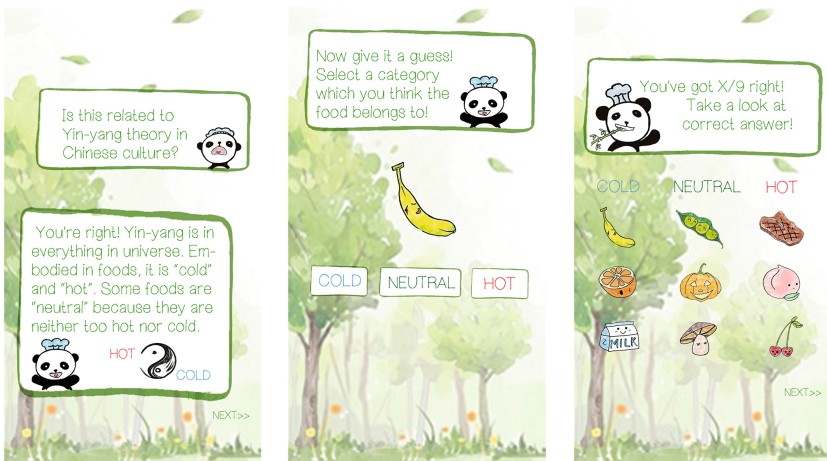


Fig. 1. Warm-up exercise in the first section

Following the warm-up exercise, there are several match-3 game levels from easy to hard. The main interactive area is a $7 * 7$ grid, where various food items are randomly distributed. The goal is to eliminate enough cold or hot foods according to instructions. In the first section, a yin-yang shaped pan is designed as status bar to visualize the connection between food and medical philosophy. As players eliminate more and more target foods, the corresponding hemisphere increases from empty to full. In the second section, players are required to eliminate target foods to neutralize cold or hot types of body constitutions. The abstract body constitution is presented as ice or fire icons.



Fig. 2. Warm-up exercise in the second section

Since the whole game context is about food and Chinese culture, some power-ups are designed with cultural implications as well. For example, the “family dinner” power-up will lengthen the countdown by five seconds. It indicates Chinese people’s emphasis on having meals with family (Table 1).

Table 1. Game elements

Elements	Icons	Implications
Food items		Cold foods
Food items		Hot foods
Status bar		Yin hemisphere: cold Yang hemisphere: hot
Ice and fire		Ice: cold body constitution Fire: hot body constitution
Power-up 1		Family dinner: adding five seconds
Power-up 2		Recipe: reminder of target foods
Power-up 3		Spoon: breaking up ice or putting up fire

To create an immersive playing experience, we incorporated background music loops and various sound effects into the game. As players conduct each operation, there are sounds of cheers or regrets, according to whether target or non-target foods are eliminated. In this aspect, *Kitchen KungFu* is different from common match-3 games, where positive feedback is plenty while negative feedback is limited [10]. Since an important goal of our game is to help players differentiate food categories, we used both positive and negative sounds to assist players' memorization (Fig. 3).

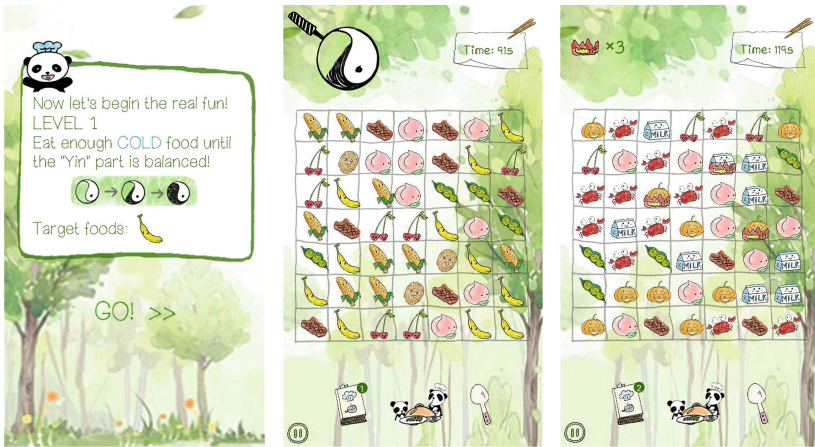


Fig. 3. Completing different levels

3.2 User Testing

In order to evaluate how *Kitchen KungFu* would influence non-Chinese people's agreement with and knowledge of Chinese medical beliefs, we conducted a user test. Ten participants were recruited, all international students studying in Tsinghua University. They came from different countries including Thailand, New Zealand, Brazil, Netherlands, France, Morocco, Bangladesh and Iran. They were instructed to play the game, and complete a questionnaire both before and after the game. An in-depth interview followed up to understand participants' detailed opinions on Chinese medical beliefs and the game.

The pre-game questionnaire consisted of five statements on Chinese medical beliefs. Participants chose their level of agreement with each statement on a 5-point Likert scale from "strongly disagree" to "strongly agree". The first four statements were set according to Chew's research on Chinese cultural beliefs, assessing participants' agreement with certain TCM concepts and practices [11]. The fifth statement measures participants' willingness to consult TCM for themselves (shown in Table 2). The post-game questionnaire included the same five statements and four questions assessing players' memorization of related knowledge. They were all multiple-choice questions, asking about the categories each food belongs to and medical solutions to specific scenarios, all of which are explicitly demonstrated in the game.

Table 2. Average answer to each statement before and after the game

Statements	Before	After
1. Certain diseases are caused by ‘too much heat’ or ‘too much coldness’ in the body (disruption of yin-yang balance)	3.8	4.2
2. Fever is due to excessive heat inside the body	3.0	3.6
3. After childbirth, the woman should take ‘hot’ foods like ginger and red wine to expel the ‘coldness’ in body	2.8	3.8
4. Traditional Chinese herbal medicine has fewer side effects than Western medicine	3.6	3.9
5. I will consider seeking TCM when I am sick	3.0	3.6

4 Results and Analysis

4.1 Data Interpretation

We calculated each participant’s level of agreement with Chinese medical beliefs by averaging their answers to the first five statements. Before the game, the mean of the ten participants’ agreement level is 3.24 (SD = 0.68). After the game, the mean is 3.82 (SD = 0.58). A paired t-test was conducted to measure the difference of agreement before and after the game ($p = 0.056$) (shown in Table 3). Considering that the number of participants is limited, the actual agreement level change was more significant than the p-value indicated. While most participants’ rated higher after the game, three persons’ answers remained the same. Abdellah, a player from Morocco, rated low on the second and third statements both before and after the game. During the interview, he explained he disagreed with the cause of fever and the childbirth practice, and since the game did not explain those aspects, his answers did not change after it. Shaya was familiar with Chinese medical beliefs before the game. She specially mentioned that the interval between two questionnaires was too short that for a person who already agreed with Chinese medical beliefs, the change could be insignificant.

Table 3. Average answer of each player before and after the game

Participants	Before	After
Shanto (Bangladesh)	1.8	3.4
Vincent (France)	3.4	4.0
Peter (Netherlands)	3.2	4.4
Yvonne (Netherlands)	3.4	3.6
Cheng (New Zealand)	4.0	4.6
Nittita (Thailand)	3.4	4.0
Rafael (Brazil)	3.0	4.0
Wildiner (Brazil)	3.4	3.4
Abdellah (Morocco)	2.6	2.6
Shaya (Iran)	4.2	4.2
Average	3.24	3.82

We also found that in certain cases, participants' agreement with the statements might not reflect their agreement with Chinese medical beliefs. For example, Vincent from France chose 2 to the statement "fever is due to excessive heat inside the body" before the game and 1 after it. He explained that since playing sports and warming up the body will help relieve the fever, the fever was instead caused by too much coldness. As a result, though Vincent believed in yin-yang theory, he used it to reach an opposite conclusion.

As to the memorization of knowledge, the last four questions have an average accuracy of 82 %, 70 %, 80 % and 70 % respectively. According to the interview, most participants did not know about cold-hot food culture nor had related knowledge before, though many of them had heard of yin-yang theory. Thus the result indicates that the game was effective in imparting knowledge and helping players develop a short-time memorization.

However, there are limitations on the sample's number and representativeness. All participants are students in Tsinghua University, from bachelor to PhD degrees. Most of them are from Asian and European countries, which could not comprehensively reflect international players' situations.

4.2 Educational Game

Overall, each player took an average of 25 min to finish *Kitchen KungFu*. Though they were told in advance that they could have certain difficult levels skipped, many insisted on finishing the whole game independently and enjoyed meeting the challenge. After the game, most participants expressed strong interest in the concept of educational game. They liked to learn while having fun, and were ready to know more about Chinese medical beliefs. One participant remarked that *Kitchen KungFu* was different from ordinary match-3 games like *Candy Crush Saga*, "Besides speed and observation, it adds another dimension. You need to remember the knowledge presented before to better pass each level."

Meanwhile, the interview provided insights into the balance of entertainment and learning in an educational game. One participant commented that he did not strive to memorize specific hot or cold foods once he found that eliminating non-target items would not reduce scores. This might suggest that the ratio of positive and negative feedback should be given more consideration.

Other factors also influence participants' interest and learning results. For example, players' technological familiarity and previous experience with match-3 games largely determined their initial inclination towards *Kitchen KungFu*. Those who were already fans of match-3 games, or those confident that they would quickly learn the game expressed a higher morale. But two participants expressed worries before the game for they seldom played mobile games before. One of them failed several levels and became a bit depressed, while the other gradually gathered confidence and passion as he became familiar with various operations.

Some usability issues, like the device's slow response and certain levels' high degree of difficulty, also had negative affect on players. Such observations and feedback provide direction for the game's future improvement.

4.3 Cultural Diversity

Though western medicine is prevalent across the world, the interview reveals participants' notion of medical diversity. Instead of taking western medicine as the only cure, many participants were open to solutions from other cultures, including TCM and traditional medicine from their own countries. Several participants expressed their preference to herbal medicine over western medicine, because herbs were more "natural" and would cause fewer side effects. A participant from Iran noted that recently in her country, instead of seeking only western healthcare, people and government were placing more emphasis on traditional medicine industry.

Traditional and modern medicine's efficacy is still a topic under heated discussion, but it is not our focus in this study. However, as medical beliefs are a facet of culture, this conveys an encouraging message that these players are, to some extent, embracing cultural diversity.

5 Conclusion

Kitchen KungFu is an exploration to present cultural values through gamification. By designing a game that incorporates Chinese medical beliefs and conducting a user test after the game, our study provides valuable reference to gamification's potential for improving cross-cultural communication.

In future study, we will refine the game's visual design and improve its usability. We will also expand its educational content from yin-yang theory to more comprehensive themes like five-element theory, nutrition diet and Chinese cuisine. Meanwhile, we hope to add more variety to the game mechanics.

Acknowledgements. This study was funded by a Natural Science Foundation China grant 71188001 and State Key Lab Automobile Safety and Energy.

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