Educational Board Game and Flashcard: Which one is better for learners at beginner level of Chinese language?

Ju-May Wen[1], Hai-Dung Do[2], Eric Zhi-Feng Liu[3], Chun-Hung Lin[4], Shihping Kevin Huang[5]

[1] Department of Chinese Language and Literature at National United University,
wjmpaper@gmail.com
[2] Institute of Management of Technology at National Chiao Tung University,
dohaidzung@gmail.com
[3] Graduate Institute of Learning and Instruction at National Central University,
totem.ncu@gmail.com
[4] Center for Teacher Education at Chung Yuan Christian University, Chlin@cycu.edu.tw
[5] Institute of Management of Technology at National Chiao Tung University,
ksph@nctu.edu.tw

Abstract

The purpose of this study is to compare the impacts of flashcard and board games on the learning motivation, flow experience, and learning outcomes of learners of Chinese language. The subjects of this research were 34 learners who took beginner Chinese courses. Empirical research found out that both flashcard and board games have positively significant effects on learners' learning motivation, flow experience and learning outcomes. In which, learners in the board game group have significantly higher learning outcomes than those in the flashcards group. However, the learning motivation and flow experience of the flashcard group are significantly higher than that of the educational board game group.

Keywords: Keywords: *Chinese-language teaching, board games, game-based learning, flashcards;*

1 Introduction

Flashcards are a very common tool used in learning any foreign language, especially in learning and memorizing vocabulary [1], [2]. With the advancement of technology, flashcards nowadays are no longer as boring as printed paper cards. There are plenty of online digital flashcard websites and applications such as Quizlet, Study Stack, Flashcard Exchange, which can help learners to absorb the target language more efficiently.

Another tool that has gradually been integrated into teaching activities is board games. They have been proven to be effective in both triggering learning motivation and interest in different subjects. For example, board games are used in computer science [3], English [4], mathematics [5], etc. Moreover, board games are applied in teaching nutrition and dietary knowledge at the primary school level [6], natural science subjects at the secondary school level [7], academic-skills training at the university level [8], medical care [9], [10], [11], [12], [13], socio-scientific issues [14] and so on. This clearly shows the impact of utilizing board games in teaching various fields. However, limited research could be found on the application of board games in teaching Chinese in particular. should be worked form references in part of introduction and related words, and should be followed the format of the citation of the journal.

Poole et al. [15] introduced a board game that is proven to improve Chinese learning by providing a learning environment that promotes peer learning and diminishes learners'

fear of failure. However, one of the highest challenges that face Chinese teachers is how to make learners practice the language in their daily life. One solution is immersing the learners in the context during the learning process. Educational board games are one of the suggested solutions that may help learners immerse into the context in order to gain knowledge. The purpose of this study is to compare the impacts of the long-proven teaching tool (Flashcards) and the newly adopted tool (Board games) on learners of Mandarin with different aspects, including the differences in learning motivation, the flow experience, and the learning outcomes.

2   Literature Review

2.1 Participatory Design and Learning

Flashcards are used via writing the corresponding contents on both of front and back sides for learning purposes in different fields such as learning chemistry [16][17], and mathematics [18][19][20]. Green and Bailey [21] interviewed some learners to get their thoughts on the use of digital flashcards. They found that learners had positive attitudes towards using digital flashcards in reviewing. Flashcards are the most commonly used method in learning and memorizing vocabulary learning when learning foreign languages [1], [2]. For example, when learning Chinese, Chinese vocabularies are written on one side and the translation and pinyin of vocabularies on the other side. When the learners see the Chinese word on the first side, the meaning of it will pop immediately into their minds. Traditional flashcards only require small pieces of paper, which are very easy to make and use. They are suitable for use in fragmented free time such as commuting. With the advancement of technology nowadays, there are many online digital flashcard tools, namely Quizlet, Study Stack, Flashcard Exchange. They could also be used with smartphone browsers or applications, achieving learning goals at any time and any place. In classrooms, powerpoint can also be used to make flashcards and project them on the screen for learners to practice.

2.2 Using board games in learning

Board games are used to be entertainment-oriented and have been used in teaching or evaluation in recent years. Among the research, medical-and health-related research is found to be the most. Bochennek et al. [22] showed that board games are widely used in medical teaching aspects via covering various ages and many different medical topics. It can even reduce the risk of Alzheimer's disease [23]. In addition to medical health education, there are numerous board games for public transportation route planning and investment education [24], physical chemistry [25], [26], [27], mathematics [28]. Adair and McAfee [29] found that board games provide an interesting way to improve college students' understanding of chemistry concepts. Since the experiment lasted three hours through the time of the lecture, students had time to review other materials and make some improvements in their weaknesses and shortcomings. Siegler and Ramani's [30] studied the effect of numerical board games and they found that they can help in minimizing the gap between low-income children's and middle-income children's numerical ability. Another example of using board games is that Kirikkaya et al. [31] designed a board game, which is to enhance and evaluate the knowledge of space galaxies.

For teaching foreign languages in general and teaching Chinese in particular, few scholars pay attention to the application of board games. Łodzikowski et al. [32] found that using board games to teach English as a foreign language at the university level promoted in-class engagement and post-class quiz scores. In their exploratory study, learners showed favor of playing board games rather than working on worksheet

exercises. Poole et al. [15] presented an educational board game that provides a learning environment in which players could improve both mathematics and Chinese language learning procedure. In essence, the board game boosts peer learning and reduces the fear of failure of learners.

3   Research Method

3.1 Participatory Design and Learning

Thirty-four participants have joined this research. These learners are all at the beginner level of Chinese proficiency. The participants are divided into two groups. One of them is the control group which includes 16 people (male: 10, female: 6). The nationalities embrace 6 from Sweden, 5 from India, 2 from France, 2 from Germany, and 1 from Egypt with an average age of 23. The other group is an experimental group which has a total of 18 participants (male: 12, female: 6). The group has 4 from Indonesia, 2 from Holland, 1 from Italy, 1 from Belgium, 1 from Germany, 1 from Thailand, 4 from France, 2 from India, 1 from Japan and 1 from Bosnia with an average age of 24..

The Chinese ability of all the learners are at the preparation level according to the Test of Chinese as a Foreign Language (TOCFL) standard. At the preparation level, the learners know fewer than 300 words. The TOCFL is designed to assess the Chinese proficiency of non-Chinese speakers. The TOCFL is designed based on the Common European Framework of Reference for Languages (CEFR). The TOCFL is divided into six levels and three stages. The control group and experimental group have 16 and 18 learners respectively.

3.2 Research tools

3.2.1 Learning motivation scale
The learning motivation scale is adapted from the motivated strategies for learning questionnaire (MSLQ) that Pintrich, Smith, Garcia, and Mckeachie developed in 1991 [33].The scale has 31 items and six dimensions: intrinsic motivation (four items), extrinsic motivation (four items), task value (six items), and control belief (four items), self-efficacy for learning and performance (eight items), and learning anxiety (five items). Items of the learning motivation scale were all rated on a six-point Likert scale (1 = strongly disagree to 6 = strongly agree).

Intrinsic goal orientation focuses on the inner reasons why students participate in a task: curiosity, self-development, or satisfaction. Extrinsic goal orientation is concerned about the outer reasons why students participate in a task: money, grades, or praise from others. Task value refers to the student's perception or awareness about the material or task in terms of usefulness, importance, or applicability. The component of expectancy contains two elements: control beliefs (four items), and self-efficacy for learning and performance (eight items). Control beliefs refer to the students' belief that their effort would lead to a positive result. Self-efficacy for learning and performance refer to the judgment about one's ability to complete the task and the confidence in one's skills to accomplish the mission. The component of affective contains one element: test anxiety (five items). Test anxiety refers to the negative emotion related to taking exam.

The Cronbach α of the six components in the motivation scale ranged from .62 ~ .93, and it showed that the scale has good reliability. A confirmatory factor analysis was used to establish the construct validity of the motivation scale. The Lambda-ksi estimates of the 31 items in the motivation scale ranged from .38 ~ .89.

3.2.2 Flow experience scale
The flow experience scale was adapted from Chiang, Lin, Cheng, and Liu's [34] flow experience questionnaire. The scale had 14 items and two dimensions: flow experience

perception (11 items) and self-awareness toward flow experience (three items). Items of the flow experience scale were all rated on a 6-point Likert scale (1 = strongly disagree to 6 = strongly agree). The value of Cronbach's α of the flow experience scale reached .95 and showed that this scale had good reliability.

3.2.3 Learning outcome paper test

The learning outcome test used in this study is mainly used to test learners' understanding of the contents of the "Conveyance GO" educational board game. There are 26 questions in five dimensions, with a total score of 100, including 10 tone questions (30%), six pinyin questions (18%), four Chinese measure words questions (12%), five reading questions (15%), and one big writing task (25%).

After designing the questionnaire, a content validity test was conducted by inviting two other Chinese language teachers to evaluate the questionnaire. These two teachers have an average of six years of work experience in teaching Chinese. A content validity test is to ensure the comprehensiveness, representativeness, appropriateness, and whether it covers lesson content. In addition, face validity was also conducted with two students to test transparency, ease of understanding, and completeness. After content validity and face validity tests, a pre-test is performed before the experiment, and the post-test is performed after the experiment.

3.3 Course design

The Chinese course lasts for one semester (36 hours in 18 weeks). The experiment period is three weeks, from the 15th to 17th weeks of the semester. The course is conducted in a consistent mode: two hours per week, two to three weeks for one topic, one week for teaching vocabulary and grammar, and then the following week for passages in text books and mixed exercises; different games are integrated into teaching every two weeks. In the experiment period from the 15th to the 17th week, the learning topic is ＂environmental protection." The educational board game "Conveyance GO" is integrated into Chinese teaching in this period. The experiment period was not integrated into the first several weeks of semester because learners are foreigners and most of them have just come back or go to school after a long vacation. They are still not familiar with the new environment or curriculum of the new semester yet. Researchers hope that after getting more familiar with game-based learning in previous weeks learners will have no problems in the experiment period as board games are integrated in teaching, and as a result, there will be fewer chances for biased errors.

3.4 Introduction of educational board game "Conveyance GO"

Liu and Chen [35] developed educational board game Conveyance GO, which has a storyline related to the environmental protection issue. The main goal of the player is to use the combination of transport cards and energy cards to earn the score as much as possible (Table 1).The number of players is two to five, and the game time is about 30 minutes.

All players withdraw one role card to depart from the starting point. Each player is given 6 cards, including 3 transport form cards, 3 energy cards. The key mission of players is to pass an arranged terrain to reach the end point fastest with the lowest pollution value. When players encounter question marks in the terrain, they withdraw one problem card. If they answer the question on the other side of the problem card correctly, they earn one score card (equal one score). When players encounter an exclamation mark, they withdraw one event card then follow what is said in the card. Players can use negotiating skills to trade cards with other players. The player who first reaches the end point is not necessarily the winner (Table 2).

Players have to consider the number of pollution cards that come along with the transport form card they used to reach the end. The winner is found out by the final score, that equal earned points minus pollution value (Figure 1).

Table 1. *Introduction of Conveyance GO board game cards and functions*

| Types of card	Functions
	Transport form cards including marine, land and aviation transport. Transport forms consume different types of energy and enable players to move different numbers of steps. Transport forms consume oil will come with a pollution card with pollution value. Transport modes that use electricity, wind power, or solar power, do not produce pollution.
	There are 4 types of energy cards namely solar, electricity, old and wind. Solar power energy cards can be used to replace other energy cards such as oil to demonstrate the convenience and wide applicability of solar power.
	Problem and event cards require students to answer questions or follow guidelines in the cards respectively. One correct answer for problem cards helps players earn one score card, that equals one point.
	Score and pollution cards are used to calculate the final score as the game ends.
	Terrain cards are put to create routes for the game. Two types of terrain are included in the game (land and sea) and three forms of transport travel by land, sea, or air.. In the game, ship transports can only travel by sea, land transports can only travel by land, and aviation transport is not limited by terrain.
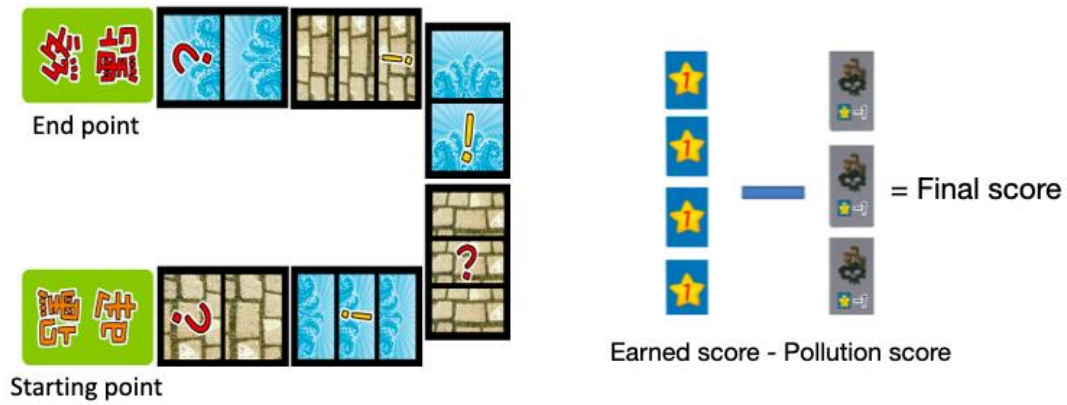
Figure 1. *Board game scoring method*

Table 2. *Final score calculation*

Arriving point	Question point	Pollution value	Final score
1st arrival = 4 point 2nd arrival = 3 point 3rd arrival = 2 point 4th arrival = 1 point	1 correct answer = 1 point	One pollution card = - 1 point	Final score = Arriving point + question point - pollution value

After the teacher explains the rules of the game, the learners are given a vocabulary table, which includes vocabularies related to the game with pinyin, and English translation, so that the learner can find the corresponding words by themselves during the game process, enhancing self-learning ability (Figure 2).

Figure 2. *Learner use vocabulary table*

3.5 Research design

The following is a description of the research design, research objects, research hypotheses, research tools, data collection methods, and data analysis methods from Study. The figure 3 is the structural diagram of the study to illustrate the relationship between the variables.
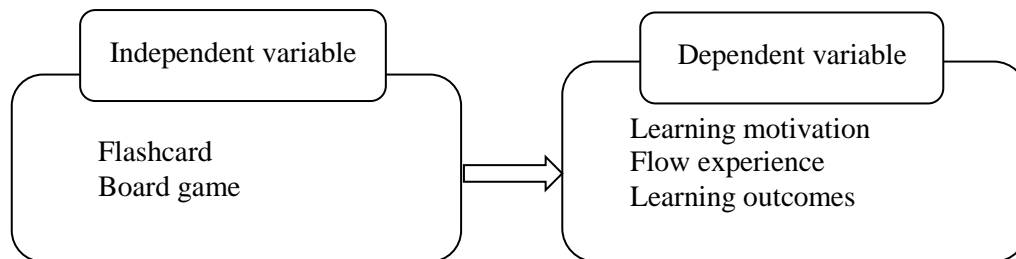

Figure 3. *Conceptual framework*

The experiment design is shown in Figure 4. In the first week of the experiment period, the pre-test is conducted in both the control and experimental groups. The content is tested in the following parts: listening, reading and writing, as well as vocabulary. From the second week, in the control group, the teacher used cards from board game Conveyance GO as flashcards to teach vocabulary and review lesson content. In the first round of the activity, the teacher randomly draws out cards to let the learners raise their hands to answer. In the second round, the teacher assigns learners into groups of three, each with different tasks. One learner is responsible for raising their hands, one learner is responsible for reading the birth word, and the last one is responsible for making sentences with the vocabulary in the card. The tasks of each learner in the group will be rotated. In the third round of activities, random learners are picked to answer random questions related to vocabulary in the cards.

Meanwhile, in the experimental group in the second week, the teacher explains the rules of Conveyance GO then learners play the game. In the third week, both groups take a post-test to test learning motivation and flow experience. In the end, interviews with learners are conducted.
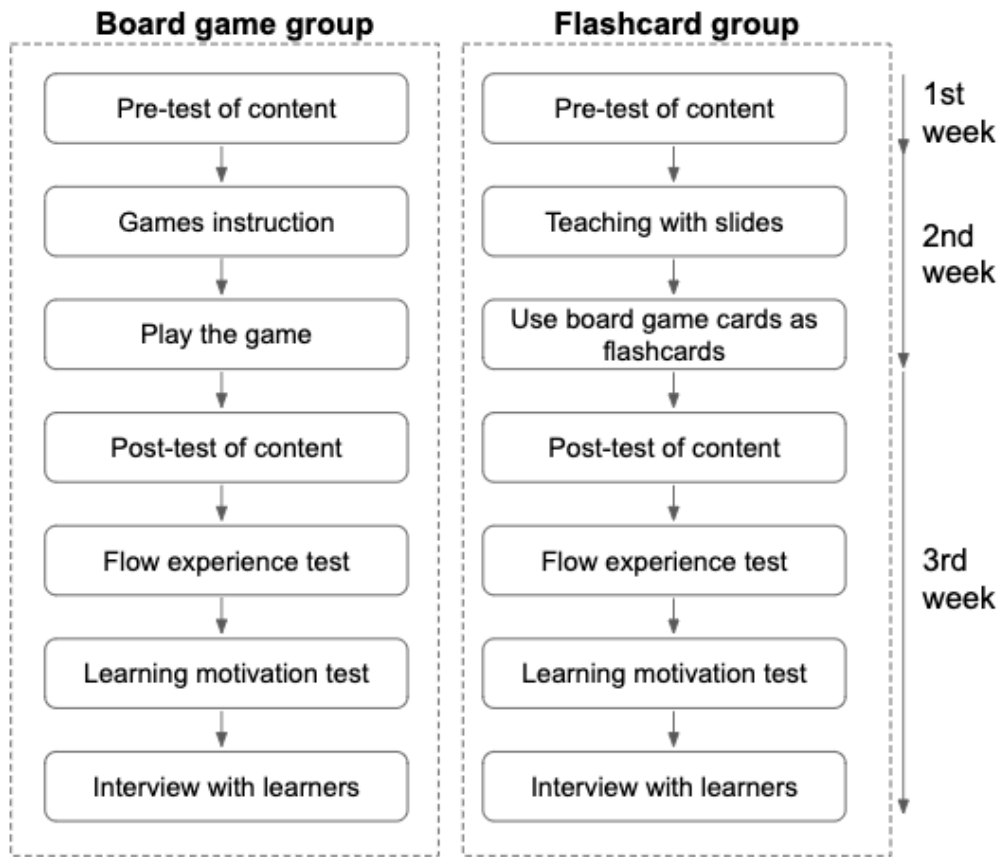
Figure 4. *Experiment design*

4 Research Results

4.1 The flashcard group's learning motivation and flow experience is significantly higher than that of the board game group

According to the results of Table 3 and Table 4, the experience of the experimental group and the control group is higher than 3.5, which means both flashcard group and the board game group give learners high learning motivation and high flow experience. The control group's flow experience (t = -3.86, p = .001 < .01) and learning motivation (t = -2.58, p = .01 < .05) were significantly higher than that of the experimental group.

Table 3. *Independent sample t-test analysis on flow experience*

	N	*M*	*SD*	*t*	**Cohen's *d***
Control Group (Flashcard)	16	4.77	.78		
				-3.86**	1.34
Experimental Group (Board game)	18	3.75	.74		

Note. **P < .01
Cohen (1988) d = .2, d = .5, d = .8 means low, medium, high effect size

Table 4. *Independent sample t-test analysis on learning motivation of control and experimental groups*

	N	M	SD	t	Cohen's *d*
Control Group (Flashcard)	16	4.49	.56		
				-2.58*	.89
Experimental Group (Board game)	18	3.93	.69		

*Note.*P < .05.*
Cohen (1988) d = .2, d = .5, d = .8 means low, medium, high effect size

The results of interviews with learners show that learners like to learn from board games. Most of them think that board games are an interesting way of learning. However, in the process of playing a board game, learners have to memorize the game's rules and the content of the lesson. In addition, players also have to speak out to communicate with others, causing excessive load; as a result, learning motivation and flow experience in the experimental group is significantly not as high as that of the control group. The answers of interviewees are as below:

"The game is good, but it is hard to read the card(!/?). Sometimes it will stuck at there. Maybe if the game is played will one people that can read correctly, it will be better." (E1)

"The game is fun but not so good at this level as it is too hard. "(E3)

"The game is interesting, but there are many difficult words." (E5)

"Game is ok. Hard to build sentences. Maybe more training is needed. Dilticulland many words to learn."(E6)

4.2 Both flashcards and board games help improve learning outcomes significantly

According to Table 5 and Table 6, the post-test scores of both the control group and experimental group are significantly higher than the pre-test scores with the high effect size (d = 2.27 and d=2.01 respectively). The advantage of using board game cards as flashcards is to display the picture and the vocabulary at the same time; hence, it is not necessary to use the translation to make the learner understand the meaning of the vocabulary, which makes it easier for beginners to remember and memorize new words. Meanwhile, in the board game group, learners believed that in the process of playing the board game, in order to win the game, there was a chance to motivate himself or herself to use Chinese to complete the tasks in the game.

The game is good because I can use my Chinese skills to win the game and it encovenages to think creatively to win the game." (E2)

Table 5. *Dependent Sample t-test analysis on pre- and post-test scores of learners in control group*

	N	M	SD	t	Cohen's d
Pre-test	16	39.18	13.77		
				9.68***	2.27
Post-test	16	72.00	15.07		

Note. ***P < .001
Cohen (1988) d = .2, d = .5, d = .8 means low, medium, high effect size

Table 6. *Dependent sample t-test analysis on pre- and post-test scores of learners in experimental group*

	N	M	SD	t	Cohen's d
Pre-test	18	49.44	20.66		
				8.49***	2.01
Post-test	18	81.66	9.13		

Note. ***P < .001
Cohen (1988) d = .2, d = .5, d = .8 means low, medium, high effect size

4.3 Learning outcomes of the board game group are significantly higher than that of the flashcard group

Table 7 shows that there was no significant difference in the pre-test scores between the control group and the experimental group (t = 1.68, p = .10 > .05), indicating that there was no significant difference in the initial Chinese ability of learners in the two groups. Table 8 shows that there was a significant difference in the post-test scores between the control group and the experimental group (t = 2.29, p = .02 < .05), with a medium effect (d = .78). It can be seen that as the board game is integrated into teaching Chinese, its learning outcome is significantly higher than that of the flashcard group. Although it takes a longer time to play educational board games and there were also some difficulties and setbacks in the process of playing, the learning outcome is significantly higher than that of the group using simple and easy-to-play flashcards. The board game provides a context and puts learners in a practical situation; as a result, learners are able to use words in target language more accurately.

Table 7. *Independent sample t-test analysis on pre-test scores of both groups*

	N	M	SD	t	Cohen's d
Control Group (Flashcard)	16	39.18	13.77		
				1.68	.58
Experimental Group (Board game)	18	49.44	20.66		

Note.
Cohen (1988) d = .2, d = .5, d = .8 means low, medium, high effect size

Table 8. *Independent sample t-test analysis on post-test scores of both groups*

	N	M	SD	t	Cohen's *d*
Control Group (Flashcard)	16	72.00	15.07		
				2.29*	.78
Experimental Group (Board game)	18	81.66	9.13		

*Note.*P < .05.*
           Cohen (1988) d = .2, d = .5, d = .8 means low, medium, high effect size

4.4 Analysis of qualitative data

From the important findings observed in the classroom by the teacher and interview data with learners, learner's views and opinions about the whole activity design are explained. The above is a horizontal analysis of all the learners as a unit (Figure 5). In order to protect the privacy of learners, the learners are coded as follows: the control group code is C, the experimental group code is E, the learner number starts from 1. For example, the third learner of the control group is C3.

Based on the grounded theory proposed by Barney G. Glaser and Anselm Strauss [36], the context is integrated from actual research, and the interview content of the flashcard group and the board game group is organized, inferring the factors that affect the learning patterns, which are divided into two aspects: helping learning and hinder learning. The architecture diagram is as follows:
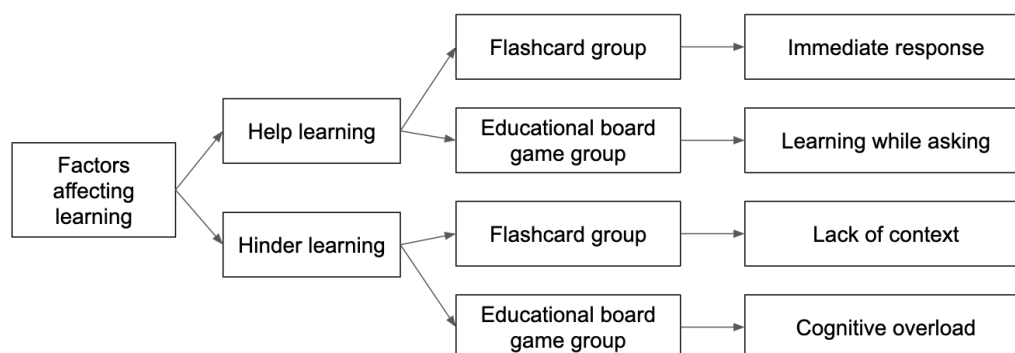

Figure 5. *Structure diagram of qualitative data from interviews*

4.5 Help learning

4.5.1 Immediate response in flashcard group
Based on observation of researchers during the teaching process, learners in the flashcard group performed higher efficiency in memorizing vocabulary.

   "The game is good because I can remember new vocabulary." (C9)

   "These will reappear and help me remember new words." (C7)

   Flashcards have been used for personal use in learning languages. It also proved its efficiency as integrated into teaching activities.

4.5.2 Learning while asking in educational board game group

One of the main purposes of this study is to explore the knowledge content that is naturally acquired during the experience of the board game. In the classroom observation of the board game activities, the researchers found learners are more brave to raise hands asking questions. Because teachers walked around the groups to observe students playing the board game, instead of standing on the stage, which shortens the distance between students and teacher figuratively and physically. By asking questions, learners also absorb knowledge naturally like E17 mentioned: "I love this game. I asked teachers then I can learn something."

In addition, when some groups encounter problems, their peers will discuss with each other first. If no one in the group knows the answer, they resort to asking the teacher. In the process of the activity, learners believe that because of the game mechanism, they must use negotiation skills to play the games, so that they could learn new words. There were also learners who feel that experiencing board games seems to be learning in real situations. Their responses are as follows:

"The game was really good to practice to negotiate when you need a card. It is nice to learn transport vocabulary, but I fear to forget many of the words that we don't learn every day." (E8)

"This game is very good, just like experiencing the real situation, but it needs more time to experience the game. "(E13)

In summary, the educational board game provides learners practical context and situations, allowing them to naturally discover problems, solve problems, and then acquire knowledge during the game. During the activity, the learners can ask and learn while forming a unique learning mode Type-style and fonts

Wherever Times New Roman is specified, Times Roman, or Times may be used. If neither is available on your word processor, please use the font closest in appearance to Times New Roman that you have access to. Please avoid using bit-mapped fonts if possible. True-Type 1 fonts are preferred.

4.6 Hinder learning

4.6.1 Lack of context

After practicing vocabularies, although it allows learners to remember new words in a short period of time, it is difficult for learners to speak complete sentences fluently. In the interview, one learner said:

"This way is ok but hard to make sentences. Maybe more training is needed." (C4)

After all, it is necessary for learners at beginner level to have more practice making sentences. It can be seen that it is extremely difficult for the learner to make sentences out of nowhere under no circumstances. Some learners also mentioned that these new words about transportation are difficult or not very useful for them , and they need a little more time to practice how to speak sentences:

"The activity is good but we need to learn some vocabulary before practice, because it is quite hard to learn transportation vocabulary in Chinese. We need more time." (C10)

"It allows us to use the words we learnt and practice in small groups. Some words are not very important or useful (E.g: speedboat)." (C14)

Although it is hard for students to immediately put those vocabularies into sentences, the learners did not give up, but hope to have a little more practice opportunities.

4.6.2 Cognitive overload
During the activity, the researchers found that learners' mood changed from "excited when heard of board games" to "frustrated by the game's rules". Some learners said that questions popping up from cards "?" and "!" are very difficult, plus there is no pinyin for them to read, so that it is hard for them to understand and answer the questions. In addition, words' fonts in board game cards are a little different from standard fonts in the vocabulary table that is provided for students to scheme those vocabularies related to the game, causing some students could not recognize the words.

"The game is good, but it is hard to read the card (! /?). Sometimes it will be stuck there. Maybe once the game is played, if we have one person who can read correctly, it will be better." (E1)

"Most importantly the cards were in Chinese (high level) difficult to read. I would have preferred to play a game where we could easily understand what was happening."(E11)

It can be seen that the game rules and learning content must be remembered during the game, and the use of oral socialization caused excessive load, so that the performance of flow experience and learning motivation in the educational board game group is not as high as the flashcard group. The application of educational board games should be appropriate, and the cognitive load should not be too heavy in order to achieve learning goals.

Figure 6. *Playing board game activity*

5   *Suggestions and discussion*

In the future, games can be digitized. By doing this, it can reduce printing costs and increase the convenience for not only players, but also instructors to record players' behaviors.

Future research can consider the difficulty of game design and content. It should be not just for fun. Complex game mechanics may cause negative effects. We need to clarify the teaching objective, then decide the appropriate teaching method. For example, a flashcard can make learners more excited, but it cannot put learners into a practical context, so it helps review vocabulary only. On the other hand, board games can provide more practical context that helps learners learn more actively and naturally. If the teaching goal is to make learners happy or simply help them learn vocabularies better, it is recommended to use flashcard teaching. If the goal of teaching is to enable learners to improve their speaking ability, it is recommended to use a board game.

During the course, the researchers observed that each team would naturally have a leader. The leader would convince other learners to refer to his/her strategy, and sometimes he/she also becomes an arbiter. When the team members have a dispute, they can mediate the dispute and let the activity go smoothly. Therefore, in the future, it is also possible to study whether learners with high social skills will have a higher chance of high learning outcomes. Will learners with low social skills have a low learning outcome or can they enhance learning outcomes and social skills through this activity?

In order to cope with the problem that learners do not want to learn and feel that the content of the course is boring, some instructors design games as teaching tools. Lesson content is covered by games with the hope of increasing learning motivation. Many teachers believe that by increasing extrinsic motivation, intrinsic motivation will be raised accordingly. However, this method sometimes has a placebo effect in the short term. If students find out this is just a covered teaching tool, they may lose interest, and it will fail to initiate their intrinsic motivation. Games should be designed to be well-matched with learning content. For example, when learners want to pass a level in the game, they must all rely on their Chinese ability to pass.

6   Conclusion

The flashcards and board games applied to teaching Chinese all may help learners to have high learning motivation and flow experience. They all help increase learners' learning motivation and flow experience. However, both flashcards and board games have factors that help and hinder learning at the same time, leading to differences in learning motivation, flow experience, and learning outcomes as well. Flashcards require learners to have intermediate responses meanwhile, board games enable learners to learn while asking questions during the playing game process. Those factors boost the learning outcomes in both groups significantly. However, because of the cognitive load from learning rules of board games, learners who are in the board game group have significantly lower learning motivation and flow experience than those in the flashcard group. As compensation for cognitive load, playing a board game is competitive and communicative, providing learners practical situations that flashcards cannot. As a result, learners in the board game group are able to use words in the target language more accurately and gain higher learning outcomes.

References

[1] T.Fitzpatrick, I.Al-Qarni, andP.Meara, "Intensive vocabulary learning: A case study," *Lang. Learn. J.*, vol. 36, no. 2, pp. 239–248, 2008, doi: 10.1080/09571730802390759.

[2] M. E.Komachali andM.Khodareza, "The effect of using vocabulary flash card on Iranian pre-university students' vocabulary knowledge," *Int. Educ. Stud.*, vol. 5, no. 3, pp. 134–147, 2012, doi: 10.5539/ies.v5n3p134.

[3] M.Papastergiou, "Digital Game-Based Learning in high school Computer Science education: Impact on educational effectiveness and student motivation," *Comput. Educ.*, vol. 52, no. 1, pp. 1–12, 2009, doi: 10.1016/j.compedu.2008.06.004.

[4] T. Y.Liu andY. L.Chu, "Using ubiquitous games in an English listening and speaking course: Impact on learning outcomes and motivation," *Comput. Educ.*, vol. 55, no. 2, pp. 630–643, 2010, doi: 10.1016/j.compedu.2010.02.023.

[5] K. E.Chang, L. J.Wu, S. E.Weng, andY. T.Sung, "Embedding game-based problem-solving phase into problem-posing system for mathematics learning," *Comput. Educ.*, vol. 58, no. 2, pp. 775–786, 2012, doi: 10.1016/j.compedu.2011.10.002.

[6] S.Amaro *et al.*, "Kalèdo, a new educational board-game, gives nutritional rudiments and encourages healthy eating in children: A pilot cluster randomized trial," *Eur. J. Pediatr.*, vol. 165, no. 9, pp. 630–635, 2006, doi: 10.1007/s00431-006-0153-9.

[7] G. J.Hwang andP. H.Wu, "Advancements and trends in digital game-based learning research: A review of publications in selected journals from 2001 to 2010," *Br. J. Educ. Technol.*, vol. 43, no. 1, pp. 6–10, 2012, doi: 10.1111/j.1467-8535.2011.01242.x.

[8] K.Markey *et al.*, "Designing and testing a web-based board game for teaching information literacy skills and concepts," *Libr. Hi Tech*, vol. 26, no. 4, pp. 663–681, 2008, doi: 10.1108/07378830810920978.

[9] N.Charlier, "Game-based assessment of first aid and resuscitation skills," *Resuscitation*, vol. 82, no. 4, pp. 442–446, 2011, doi: 10.1016/j.resuscitation.2010.12.003.

[10] V.Gibson andM.Douglas, "Criticality: The experience of developing an interactive educational tool based on board games," *Nurse Educ. Today*, vol. 33, no. 12, pp. 1612–1616, 2013, doi: 10.1016/j.nedt.2013.01.022.

[11] B. D.Mann, B. M.Eidelson, S. G.Fukuchi, S. A.Nissman, S.Robertson, andL.Jardines, "The development of an interactive game-based tool for learning surgical management algorithms via computer," *Am. J. Surg.*, vol. 183, no. 3, pp. 305–308, 2002, doi: 10.1016/S0002-9610(02)00800-0.

[12] J.Berry andC.Kenny, "The utilization and evaluation of a simulation game in pre-registration nurse education.," *Nurse Educ. Today*, vol. 16, no. 5, pp. 69–77, 1996.

[13] M.Cutumisu *et al.*, "RETAIN: A board game that improves neonatal resuscitation knowledge retention," *Front. Pediatr.*, vol. 7, no. JAN, pp. 1–7, 2019, doi: 10.3389/fped.2019.00013.

[14] P. H.Cheng, T. K.Yeh, Y. K.Chao, J.Lin, andC. Y.Chang, "Design ideas for an issue-situation-based board game involving multirole scenarios," *Sustain.*, vol. 12, no. 5, pp. 1–20, 2020, doi: 10.3390/su12052139.

[15] F.Poole, J.Clarke-Midura, C.Sun, andK.Lam, "Exploring the pedagogical affordances of a collaborative board game in a dual language immersion classroom," *Foreign Lang. Ann.*, vol. 52, no. 4, pp. 753–775, 2019, doi: 10.1111/flan.12425.

[16] A.Cancela, A.Sanchez, andR.Maceiras, "Designing a flashcard with knowledge pills for learning to solve chemistry exercises," *Eur. J. Eng. Educ.*, vol. 37, no. 4, pp. 366–374, 2012, doi: 10.1080/03043797.2012.697128.

[17] C.Draghici andJ. T.Njardarson, "Chemistry by design: A web-based educational flashcard for exploring synthetic organic chemistry," *J. Chem. Educ.*, vol. 89, no. 8, pp. 1080–1082, 2012, doi: 10.1021/ed2006423.

[18] P.Glover, T.McLaughlin, K. M.Derby, andJ.Gower, "Using a direct instruction flashcard system with two students with learning disabilities," *Electron. J. Res. Educ. Psychol.*, vol. 8, no. 2, pp. 457–472, 2010.

[19] A.Skarr, K.Zielinski, K.Ruwe, H.Sharp, R. L.Williams, andT. F.McLaughlin, "The effects of direct instruction flashcard and math racetrack procedures on mastery of basic multiplication facts by three elementary school students," *Educ. Treat. Child.*, vol. 37, no. 1, pp. 77–93, 2014, doi: 10.1353/etc.2014.0007.

[20] R. V. H. A.Rolider, "An analysis of several variables influencing the efficacy of flash card instruction," *J. Appl. Behav. Anal.*, no. 1, 1989.

[21] T.Green andB.Bailey, "Digital Flashcard Tools," *TechTrends*, vol. 54, no. 4, pp. 16–18, 2010, doi: 10.1007/s11528-010-0415-2.

[22] K.Bochennek, B.Wittekindt, S. Y.Zimmermann, andT.Klingebiel, "More than mere games: A review ofcard and board games for medical education," *Med. Teach.*, vol. 29, no. 9–10, pp. 941–948, 2007, doi: 10.1080/01421590701749813.

[23] M. D.Joe Verghese, M.D., Richard B. Lipton, M.D., Mindy J. Katz, M.P.H., Charles B. Hall, Ph.D., Carol A. Derby, Ph.D., Gail Kuslansky, Ph.D., Anne F. Ambrose, M.D., Martin Sliwinski, Ph.D., and Herman Buschke andAbstract, "Leisure activities and the risk of dementia in the elderly," pp. 2508–2516, 2003.

[24] J. F.Hacker, G. R.Krykewycz, andJ. M.Meconi, "Dots & Dashes: Transit planning outreach and education in a board game format," *Transp. Res. Rec.*, no. 2138, pp. 127–134, 2009, doi: 10.3141/2138-17.

[25] E.Triboni andG.Weber, "MOL: Developing a European-Style Board Game to Teach Organic Chemistry," *J. Chem. Educ.*, vol. 95, no. 5, pp. 791–803, 2018, doi: 10.1021/acs.jchemed.7b00408.

[26] S.Brydges andH. E.Dembinski, "Catalyze! Lowering the Activation Barriers to Undergraduate Students' Success in Chemistry: A Board Game for Teaching Assistants," *J. Chem. Educ.*, vol. 96, no. 3, pp. 511–517, 2019, doi: 10.1021/acs.jchemed.8b00544.

[27] D.Dziob, "Board Game in Physics Classes—a Proposal for a New Method of Student Assessment," *Res. Sci. Educ.*, vol. 50, no. 3, pp. 845–862, 2020, doi: 10.1007/s11165-018-9714-y.

[28] J.Skillen, V. D.Berner, andK.Seitz-Stein, "The rule counts! Acquisition of mathematical competencies with a number board game," *J. Educ. Res.*, vol. 111, no. 5, pp. 554–563, 2018, doi: 10.1080/00220671.2017.1313187.

[29] B. M.Adair andL.V.McAfee, "Chemical Pursuit: A Modified Trivia Board Game," *J. Chem. Educ.*, vol. 95, no. 3, pp. 416–418, 2018, doi: 10.1021/acs.jchemed.6b00946.

[30] R. S.Siegler andG. B.Ramani, "Playing linear numerical board games promotes low-income children's numerical development," *Dev. Sci.*, vol. 11, no. 5, pp. 655–661, 2008, doi: 10.1111/j.1467-7687.2008.00714.x.

[31] G.Kirikkaya, E. B., Iseri, S., & Vurkaya, "A BOARD GAME ABOUT SPACE AND SOLAR SYSTEM FOR PRIMARY SCHOOL STUDENTS," vol. 9, no. 2, pp. 1–13, 2010.

[32] K.Łodzikowski andM.Jekiel, "Board games for teaching English prosody to advanced EFL learners," *ELT J.*, vol. 73, no. 3, pp. 275–285, 2019, doi: 10.1093/elt/ccy059.

[33] P. R. . A. O.Pintrich andA, "A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ)," *Mediterr. J. Soc. Sci.*, vol. 6, no. 1, pp. 156–164, 1991.

[34] Y. T.Chiang, S. S. J.Lin, C. Y.Cheng, andE. Z. F.Liu, "Exploring online game players' flow experiences and positive affect," *Turkish Online J. Educ. Technol.*, vol. 10, no. 1, pp. 106–114, 2011.

[35] E. Z. F.Liu andP.-K.Chen, "The Effect of Game-Based Learning on Students' Learning Performance in Science Learning – A Case of 'Conveyance Go,'" *Procedia - Soc. Behav. Sci.*, vol. 103, pp. 1044–1051, 2013, doi: 10.1016/j.sbspro.2013.10.430.

[36] E.Glaser, B. G., Strauss, A. L., & Strutzel, "The discovery of grounded theory; strategies for qualitative research.," vol. 17, p. 1968, 1968.