

# Chinese Pharmacy Undergraduate Attitudes toward Game-Based Learning in Pharmaceutical Education

Jun Wang<sup>\*†</sup>, Xianmin Hu<sup>†</sup>, Xiamin Hu, Yajun Chen and Shiqiang Xu

Department of Pharmacy, College of Medicine, Wuhan University of Science and Technology, Wuhan-430065, China.

## ABSTRACT

Game-based learning (GBL) is a student-centered and active-learning method. But the implementing model of current GBL was not adequately consulted with students, who are the real subject and target of GBL. Thus we sought to evaluate Chinese pharmacy undergraduates' attitudes of GBL in pharmaceutical education, and the favorite implementation model of GBL to provide a more individualized and targeted teaching approach. A GBL questionnaire was administered to all the pharmacy undergraduates except graduating seniors at Wuhan University of Science and Technology. The results showed that attitudes of students towards GBL were positive. Male students generally had a more positive attitude toward GBL than females. Pharmacy students attached GBL importance to *"improving the theoretical knowledge"*, *"increasing self efficacy"* and *"enhancing awareness of the career in future"*. Among several barriers to GBL usage, *"no suitable game type"* was considered the most important. And the three most popular were role-play, singleplayer online games, and crossword puzzles. However, each of other game genres was preferred by at least 10.7% students, suggesting the pharmacy students' favorite game type is diversiform. Besides, most students reported that they were in favor of implementing GBL in normal class time or extracurricular activity. And the best organizer in the eye of the students is themselves. Nevertheless, the great majority of students had the herd mentality toward GBL, and wants to become the minor participants or audiences in the GBL. The results indicated that Chinese pharmacy undergraduates exhibited positive attitudes about GBL. And GBL with Chinese characteristic would be implemented.

**Keywords:** Pharmacy undergraduates, game-based learning, attitudes, China.

## INTRODUCTION

Undergraduate pharmacy curriculum in China consists of 4 or 5 years of full-time study to prepare students for future pharmacy practice experiences. A set of professional courses covering core areas of pharmacy as diverse as medicinal chemistry, pharmaceutics, pharmaceutical analysis and pharmacology are required for the academic degree. Because of time limitation, teaching tradition and a wide range of content that need to be covered, however, much of the material delivered to students is through passive teaching methods, which are called "duck-stuffing teaching methods", in Chinese pharmaceutical education. Many students feel that this traditional instructional method is tedious, and fail to adequately learn and apply the material. Thus, with continuous development of pharmaceutical

higher education in China, "student-centered" and active-learning methods are greatly encouraged.<sup>1,2</sup>

Use of games is an effective way of introducing active learning, and the interest in games for educational purposes is remarkably on the rise.<sup>3</sup> Unlike many other educational formats, game-based learning (GBL), as a type of game play that has defined learning outcomes, can bring fun and enjoyment to the learning experience, might encourage greater participation in group learning activities, and has potential to engage learners' emotions as well as their intellects.<sup>4</sup> Pharmacy undergraduates are 17–21 years old. These young students expect learning to be fun and interactive, and like working in teams.<sup>5</sup> Serious games, which are designed for a attempt to achieve specific learning goals other than pure

DOI: 10.5530/ijper.47.3.2

**Address for correspondence**

**Dr Jun Wang**

Department of Pharmacy,  
College of Medicine,  
Wuhan University of  
Science and Technology,  
Wuhan-430065, China

E-Mail:

wangj79@hotmail.com

<sup>†</sup>Equal contributors



[www.ijper.org](http://www.ijper.org)

entertainment, had already been used as an innovative and challenging educational method in a range of health professions education, including medicine, nursing, and pharmacy.<sup>3</sup> For example, the extra-credit bingo game was used in The Introduction to Clinical Pharmacy Skills course to increase pharmacy student interaction with course material throughout the semester and provide students many different ways of demonstrating their learning in the course.<sup>6</sup> A board game, entitled Race to Glucose, was created as a team activity for first-year pharmacy students in the biochemistry curriculum, and proven to increase pharmacy students' scores on game-related examination questions.<sup>7</sup> Another board game named Psychopharmacology R.A.C.E. game used for nursing education was considered to be a method to empower mental health clients.<sup>8</sup> The famous TV show "Jeopardy" style game was also used widely in obstetrics and gynecology core curriculum<sup>9</sup> or as a primary instructional technique to teach geriatrics,<sup>10</sup> pediatrics<sup>11</sup> and psychopharmacology<sup>12</sup> in medical education, and as a test-preparation strategy for nursing students.<sup>3</sup> Besides, web-based game was used to teach pediatric content to medical students, and was reported to facilitate access to educational resources and be feasible to apply as an adjunct to teaching clinical medicine.<sup>13</sup> In addition, crossword puzzles were created using a free Internet resource and administered to pharmacy students during lectures covering the pharmacology and medicinal chemistry of anti-ulcer agents.<sup>14</sup> These serious games used in teaching practice contribute to the acquisition and appreciation of knowledge by reviewing and reinforcing information that has already been learned, incorporate concepts and principles of adult learning including promoting self-learning and participation.<sup>3</sup> Moreover, GBL influences students and faculty members to provide beneficial and constructive feedback for improvement, encourages interaction among learners, increase learners' levels of motivation, and enhances the opportunity to learn from others,<sup>3</sup> therefore contributes to student learning. But in China, GBL is still uncommon for college students.

During our previous teaching practice, role-play and guessing game have been applied in pharmacology teaching for pharmacy and medical students respectively.<sup>1,2</sup> As an active-learning instructional tool, these games were demonstrated to be helpful to improve the study results of professional courses. However, we also find that role-play as the format of self-expression would perhaps embarrass the students or make them nervous.<sup>2</sup> Indeed, although the majority of studies describing educational games showed pharmacy students enjoy playing them,<sup>6,7,14-17</sup> unfortunately, all the games in these studies were developed by teachers according to popular

educational trend, and the implementing model was not adequately consulted with students, who are the real subject and target of GBL. We thus hypothesized that, from the perspective of students, there would be some doubts about this new teaching method which might have great influence on the result of GBL, and the more sustainable GBL model would be provided according to students' needs for Chinese pharmaceutical education. The purpose of this investigation, therefore, was to examine Chinese pharmacy undergraduates' attitudes toward GBL and favorite GBL model. Such data can inform whether their attitudes warrant the development of this new teaching method in Chinese pharmaceutical education and, if true, to better understand how those applications should be designed so as to resonate strongly with this group of learners, in order to allow educators to provide a more individualized and targeted teaching approach in Chinese pharmacy undergraduate education.

## METHODS

### Setting and population

This study was conducted from October to November 2012. All the pharmacy students except graduating seniors enrolled in Wuhan University of Science and Technology were asked to complete the questionnaire. At this university, students are accepted into the 4-year undergraduate program. Age of students at the time of entry is 17 to 19 years.

### Survey instrument

A survey instrument was developed to assess pharmacy students' attitudes, perceptions of GBL as a tool to enhance learning, and the favorite implementation model of GBL. And the survey tool was approved by the ethics committee of Wuhan University of Science and Technology. The questionnaire was specifically designed for this research, since there are no standardized materials for testing attitudes about GBL. The questionnaire was elaborated following a thorough review of relevant literatures and our previous GBL experience. Content validity was examined by asking experts (5 independent experts with a Ph.D in the covered topics) to judge whether the items cover all aspects of the domain intended to be measured. Interjudge reliability was of .95, representing an excellent level of agreement. In addition, the questionnaires were pilot tested with 30 year three students for clarity and acceptability, and minor modifications were made to increase clarity. The internal consistency reliability of the questionnaire in the pilot study was tested using (Cronbach's alpha) and was found to be >0.8. After revision, the questionnaire was distributed to all the

first, second and third-year pharmacy students. Results of the pretesting were not included in the final analysis of the data.

The final questionnaire contained 12 items that included: (1) three questions on demographics including grade and gender, and GBL experience (Table 1); (2) six questions on pharmacy undergraduate student attitudes about GBL (questions see Table 2); (3) three questions on the favorite implementation model of GBL including the game type, implementation time and the organizer (questions see Table 3). The questionnaire consisted of Likert-scale, single-choice and multiple-choice items. Three items “*I like the idea of using new teaching methods to enhance the current professional study experience*,” “*I feel the serious games can have education value*” and “*I would like to take part in GBL*” were rated on a four point Likert scale (strongly agree, agree, disagree and strongly disagree).

A participant information sheet giving the explanation on GBL and details of the study accompanied the questionnaire. The consent to participate in the survey was personally asked to each student and confidence was assured. Participants were informed that participating or declining participation in the survey would not affect grading or further opportunities at the university. Estimated time to complete the questionnaire was approximately 10 minutes. The questionnaires were distributed and collected immediately after completion by elected class representatives. Only fully completed questionnaires were included in the study and underwent further analysis.

### Data analysis

Data from questionnaires that were filled out completely were coded and entered into SPSS14.0. Frequencies and summary statistics were calculated for all variables and results presented using valid percentages. All Likert-scale responses with any degree of agreement were grouped together as positive responses, and all responses with any degree of disagreement were grouped together as negative responses. Chi-square test was used to analyze differences between male and female. Differences were considered to be significant if the  $p$  value was less than 0.05.

**Table 1: Participant Demographics**

N = 197	Total, No. (%)	Male, No. (%)	Female, No. (%)
<b>Grade</b>			
Freshman	64(32.5)	30(46.8)	34(53.1)
Sophomore	65(33.0)	19(29.2)	46(70.8)
Junior	68(34.5)	21(30.9)	47(69.1)
<b>GBL experience</b>	11(5.58)	4(36.4)	7(63.6)

## RESULTS

### Demographics

201 students (out of 204) responded though 4 incomplete surveys were eliminated. In other words, 197 students completed the questionnaire for an overall response rate of 96.6%. Among the 197 respondents, 70 (35.5%) were male and 127 (64.5%) were female; 64 (32.5%), 65 (33.0%) and 68 (34.5%) were studying in first, second and third-year of the program, respectively. Demographic characteristics of the survey tool are summarized in Table 1. Besides, only 5.58% of students had some GBL experience in their elementary and middle school.

### Pharmacy undergraduate student attitudes about GBL

Table 2 showed that an overwhelming majority of students liked the idea of using technology to enhance the current professional study experience (95.9%). A solid majority thought that the serious games can have education value (86.8%). Regardless of whether they thought that the serious games have education value, the respondents were very positive to take part in GBL (95.4%). In assessing for gender differences, we found males appeared to be more interested in GBL, because there are differences between males and females in the attitudes about the serious games and GBL ( $p < 0.05$ ;  $p < 0.01$ ).

As summarized in Table 2, the most important perceived barrier for students was that “*no suitable game type*” (86.8%). Significant difference was observed between male and female only in juniors ( $p < 0.001$ ). Interestingly, 65.5% thought that “*since I am very interested in GBL, if most classmates do not want to join, I would not really take part in GBL*”. This barrier was found in the pilot study for 30 students. And in the formal investigation, this item is considered as the second barrier to GBL use. Also important was concern for “*GBL may make me nervous*” (50.3%). And the second and third barriers worry females more than males ( $p < 0.001$ ). The difficulty of organizing, which was an important barrier of GBL in the eyes of teachers,<sup>1,2</sup> was considered to be an important barrier to GBL use by only 22.3% of students.

When considering why the students believed GBL provided an enhanced learning experience, three most frequently chosen significance of GBL are “*improving the theoretical knowledge*” (47.7%), “*increasing self efficacy*” (32.5%) and “*enhancing awareness of the career in future*” (11.1%). And more junior students (17.6%) thought GBL can “*enhance awareness of the career in future*” than the freshmen (9.4%) and sophomores (6.2%). There is no difference between male and female students with respect to this item.

**Table 2: Pharmacy Undergraduate Student Attitudes about GBL**

Statement	Grade	Total, No. (%)	Male, No. (%)	Female, No. (%)	p value
I like the idea of using new teaching methods to enhance the current professional study experience	Freshman	59 (92.2)	28 (93.3)	31 (91.2)	0.579
	Sophomore	63 (98.4)	19 (100)	45 (97.8)	0.136
	Junior	67 (98.5)	21 (100)	46 (97.9)	0.145
I feel the serious games can have education value	Freshman	46 (71.9)	23 (76.7)	23 (67.6)	0.151
	Sophomore	59 (90.8)	19 (100)	40 (87.0)	<0.001
	Junior	66 (97.1)	21 (100)	45 (95.7)	0.036
I would like to take part in GBL	Freshman	59 (92.2)	28 (93.3)	31 (91.2)	0.579
	Sophomore	64 (98.5)	19 (100)	45 (97.8)	0.136
	Junior	65 (95.6)	21 (100)	44 (93.6)	0.010
<b>I think the barriers to GBL use are:*</b>					
I used to the traditional teaching methods.	Freshman	12 (18.8)	0	12 (35.3)	<0.001
	Sophomore	12 (18.5)	3 (15.8)	9 (19.6)	0.481
	Junior	10 (14.7)	1 (4.8)	9 (15.6)	0.012
No suitable game type	Freshman	59 (92.2)	27 (90.0)	32 (94.1)	0.284
	Sophomore	56 (96.2)	16 (84.2)	40 (87.0)	0.573
	Junior	56 (82.4)	20 (95.2)	36 (76.6)	<0.001
GBL may make me nervous	Freshman	38 (59.4)	9 (30.0)	29 (85.3)	<0.001
	Sophomore	29 (44.6)	2 (10.5)	27 (58.7)	<0.001
	Junior	32 (47.1)	5 (23.8)	27 (57.4)	<0.001
GBL is hard to be organized	Freshman	19 (29.7)	2 (6.7)	17 (50)	<0.001
	Sophomore	16 (24.6)	5 (26.3)	11 (23.9)	0.696
	Junior	9 (13.2)	1 (4.8)	8 (17.0)	0.006
Since I am very interested in GBL, if most classmates do not want to join, I would not really take part in GBL	Freshman	43 (67.2)	13 (43.3)	30 (88.2)	<0.001
	Sophomore	40 (62.5)	5 (26.3)	35 (76.1)	<0.001
	Junior	46 (68.7)	5 (23.8)	41 (87.2)	<0.001
<b>I think the greatest significance of GBL in learning experience is: *</b>					
Improving the theoretical knowledge	Freshman	31 (48.4)	16 (53.3)	15 (44.1)	0.193
	Sophomore	31 (47.7)	10 (53.6)	21 (45.7)	0.264
	Junior	32 (47.1)	11 (52.4)	21 (44.7)	0.276
Enhancing awareness of the career in future	Freshman	6 (9.4)	3 (10.0)	3 (8.8)	0.771
	Sophomore	4 (6.2)	0	4 (8.7)	0.003
	Junior	12 (17.6)	3 (14.3)	9 (19.1)	0.363
Enhancing schoolmate's friendship	Freshman	2 (3.1)	1 (3.3)	1 (2.9)	0.870
	Sophomore	5 (7.7)	2 (10.5)	3 (6.5)	0.310
	Junior	1 (1.5)	1 (4.8)	0	0.027
Increasing my self efficacy such as self-educated, self-expression ability, competitiveness, innovation, organizational capability and ability to cooperate	Freshman	24 (37.5)	10 (33.3)	14 (41.2)	0.248
	Sophomore	20 (30.8)	6 (31.6)	14 (30.4)	0.854
	Junior	20 (29.4)	5 (23.8)	15 (31.9)	0.201
Winning victory to realize self-value	Freshman	1 (1.6)	0	1 (2.9)	0.086
	Sophomore	5 (7.7)	1 (5.3)	4 (8.7)	0.346
	Junior	3 (4.4)	1 (4.8)	2 (4.3)	0.865
<b>I want to become the role of GBL:</b>					
Organizer	Freshman	5 (7.8)	2 (6.7)	3 (8.8)	0.578
	Sophomore	6 (9.2)	4 (21.1)	2 (4.3)	<0.001
	Junior	9 (13.2)	5 (23.8)	4 (8.5)	0.046
Major participant	Freshman	10 (15.6)	6 (20.0)	4 (11.8)	0.130
	Sophomore	18 (27.7)	8 (42.1)	10 (21.7)	<0.001
	Junior	12 (17.6)	6 (28.6)	6 (12.8)	0.030
Minor participant	Freshman	29 (45.3)	13 (43.3)	16 (47.1)	0.589
	Sophomore	23 (35.4)	4 (21.1)	19 (41.3)	0.002
	Junior	26 (38.2)	4 (19.0)	22 (46.8)	<0.001
Audience	Freshman	20 (31.3)	9 (30.0)	11 (32.4)	0.714
	Sophomore	18 (27.7)	3 (15.8)	15 (32.6)	0.006
	Junior	21 (30.9)	6 (28.6)	15 (31.9)	0.611

\*Multiple responses were permitted, percentages do not add to 100%.



**Table 3: Favorite Implementation Model of GBL among Pharmacy Undergraduate Student**

Statement	Grade	Total, No. (%)	Male, No. (%)	Female, No. (%)	p value
<b>What are your favorite types of GBL?*</b>					
Board game	Freshman	21 (32.8)	11 (36.7)	10 (29.4)	0.272
	Sophomore	12 (18.5)	2 (10.5)	10 (21.7)	0.031
	Junior	13 (19.1)	8 (38.1)	5 (10.6)	<0.001
Guessing game	Freshman	15 (23.4)	7 (23.3)	8 (23.5)	0.973
	Sophomore	9 (13.8)	3 (15.8)	6 (13.0)	0.573
	Junior	16 (23.5)	4 (19.0)	12 (25.5)	0.269
Role-play	Freshman	30 (46.9)	16 (53.3)	14 (41.2)	0.087
	Sophomore	35 (53.8)	10 (52.6)	25 (54.3)	0.810
	Junior	35 (51.4)	8 (38.1)	27 (57.4)	0.006
The contest for knowledge	Freshman	15 (23.4)	8 (26.7)	7 (20.6)	0.310
	Sophomore	15 (23.1)	6 (31.6)	9 (19.6)	0.052
	Junior	8 (11.8)	2 (9.5)	6 (12.8)	0.458
Crossword puzzles	Freshman	17 (26.6)	6 (20.0)	11 (32.4)	0.046
	Sophomore	14 (21.5)	4 (21.1)	10 (21.7)	0.918
	Junior	19 (27.9)	5 (23.8)	14 (29.8)	0.338
Singleplayer online games such as word-matching	Freshman	9 (14.1)	5 (16.7)	4 (11.8)	0.322
	Sophomore	25 (38.5)	8 (42.1)	17 (37.0)	0.461
	Junior	16 (23.5)	4 (19.0)	12 (25.5)	0.269
Drug names Solitaire	Freshman	11 (17.2)	3 (10.0)	8 (23.5)	0.011
	Sophomore	7 (10.8)	3 (15.8)	4 (8.7)	0.126
	Junior	3 (4.4)	1 (4.8)	2 (4.3)	0.865
<b>When do you think is the best time to implement GBL?</b>					
The break between classes	Freshman	3 (4.7)	3 (10.0)	0	0.001
	Sophomore	7 (10.8)	4 (21.1)	3 (6.5)	0.003
	Junior	7 (10.3)	1 (4.8)	6 (12.8)	0.046
Review lesson	Freshman	9 (14.1)	5 (16.7)	4 (11.8)	0.322
	Sophomore	6 (9.2)	1 (5.3)	5 (10.9)	0.147
	Junior	7 (10.3)	2 (9.5)	5 (10.6)	0.796
Extracurricular activity	Freshman	19 (29.7)	6 (20.0)	13 (38.2)	0.005
	Sophomore	17 (26.2)	5 (26.3)	12 (26.1)	0.974
	Junior	18 (26.5)	11 (52.4)	7 (14.9)	<0.001
Normal class time	Freshman	18 (28.1)	11 (36.7)	7 (20.6)	0.012
	Sophomore	17 (26.2)	3 (15.8)	14 (30.4)	0.014
	Junior	18 (26.5)	4 (19.0)	14 (29.8)	0.075
Time organized specifically	Freshman	12 (18.8)	5 (16.7)	7 (20.6)	0.479
	Sophomore	9 (13.8)	4 (21.1)	5 (10.9)	0.049
	Junior	6 (8.8)	2 (9.5)	4 (8.5)	0.805
Online version of the game that I can play at any time	Freshman	3 (4.7)	0	3 (8.8)	0.002
	Sophomore	9 (13.8)	2 (10.5)	7 (15.2)	0.321
	Junior	11 (16.2)	1 (4.8)	10 (21.3)	<0.001
<b>Who do you think is the best organizer in GBL?</b>					
Professional teacher	Freshman	10 (15.6)	5 (16.7)	5 (14.7)	0.697
	Sophomore	23 (35.4)	6 (31.6)	17 (37.0)	0.421
	Junior	28 (41.2)	10 (47.6)	18 (38.3)	0.184
Class teacher	Freshman	2 (3.1)	1 (3.3)	1 (2.9)	0.870
	Sophomore	4 (6.2)	2 (10.5)	2 (4.3)	0.094
	Junior	3 (4.4)	0	3 (6.4)	0.010
Students (teachers do not participate)	Freshman	22 (34.3)	8 (26.7)	14 (41.2)	0.030
	Sophomore	25 (38.5)	8 (42.1)	17 (37.0)	0.461
	Junior	23 (33.8)	5 (23.8)	18 (38.3)	0.027
Students (teachers as guests or judges)	Freshman	30 (46.9)	16 (53.3)	14 (41.2)	0.087
	Sophomore	13 (20.0)	3 (15.8)	10 (21.7)	0.285
	Junior	14 (20.6)	6 (28.6)	8 (17.0)	0.051

\*Multiple responses no more than 2 were permitted, percentages do not add to 100%.

Besides, most of the students (69.5%) surprisingly want to become the minor participants or audiences in GBL, though the remaining (30.5%) prefer as organizers or major participants. Comparison of responses between genders demonstrated that this trend was more obvious in females, with 77.2% of females compared to 55.7% of male students wanting to become minor participants or audiences. And this genders dissonance was more significant among sophomore or junior students than freshmen ( $p < 0.05$ ;  $p < 0.01$ ).

### Favorite implementation model of GBL among pharmacy undergraduates

Table 3 illustrated the participants' favorite implementation model of GBL. Of 7 game genres presented, the three most popular were role-play (50.8%), singleplayer online games (25.4%), and crossword puzzles (25.4%). Among them, role-play was the most-preferred game for students in different grades. However, the order of other favorite game types, ranked according to the percentage of response, was different among students in different grades. The second and third most popular games were board game and crossword puzzles for freshmen, singleplayer online games and the contest for knowledge for sophomores. And crossword puzzle was 2nd; singleplayer online game and guessing game were tied for 3rd in the eyes of junior students. However, each of the remaining game genres was preferred by at least 10.7% students. When asked about the preferred time to implement GBL, most students reported that they were in favor of implementing GBL in "normal class time" (26.9%) or "extracurricular activity" (27.4%). The last preferred time when the students want to be engaged with GBL was "the break between classes", especially for males.

As indicated in Table 3, the investigation results of the best organizers in GBL were divergent. 35.5% of students showed interest in students themselves as independent organizers in GBL (teachers do not participate), though 31.0% reported professional teacher was the best organizer, and 28.9% favored students as leading organizers (teachers should participate as guests or judges). Indeed, there was a split among the students in different grades regarding the most suitable organizer: the freshmen preferred students while junior students preferred professional teachers as organizers. According to the total response of the whole sample, no statistically significant gender differences were elucidated regarding the above favorite implementation model of GBL.

## DISCUSSION

This study surveyed the attitudes of pharmacy freshman, sophomore and junior students within the

pharmacy school at Wuhan science and Technology University concerning GBL. The reason for not selecting final-year students as a target sample for this study is because they were in the internship period during the investigation, all their professional courses had been completed, and GBL had been used in their previous learning experience.<sup>2</sup>

Although GBL is widely used outside China, we found only 5.58% of students had some GBL experience in their elementary and middle school, suggesting the application of this teaching technology has great room for development in China. And our data indicate that Chinese pharmacy undergraduate students, overall, are interested in serious games as pedagogical vehicles to help them develop professional ways of knowing. This information is heartening in view of both recent calls for higher quality pharmacy education and the known doubts that Chinese educators have in the reform of pharmacy teaching. In our survey, the student responses captured the multiple benefits of GBL as supplements to traditional lecture formats. They believed that GBL can improve the theoretical knowledge, increase self efficacy and enhance awareness of the career in future. But their main motive for GBL is promoting theoretical learning, which is a little narrow. GBL can indeed offer students another opportunity to organize and synthesize drug information differently and allow for learning of the desired content.<sup>16</sup> But GBL also brings about indirect and often unexpected benefits such as participants learning about communication, social interaction, leadership and critical-thinking skills.<sup>16,18</sup> But only less than one-third of the respondents recognized these indirect benefits. The deviation of motive could make students not take initiative to GBL.

As expected, most of the students wanted to become only the minor participants even audiences in GBL. The possible reason is that, as the minor participants or audiences, students can achieve the goal of strengthening their theoretical learning without any pressure. Consistent with past research,<sup>2</sup> "GBL may make me nervous" was found in this study to be one of important barriers to GBL use. The format of educational games should create a setting to reduce student stress and anxiety,<sup>16</sup> make the learning process fun and exciting.<sup>19</sup> But in China, because the students have already used to traditional teaching class in elementary school, high school, or college, GBL is likely to frustrate students and put pressure on them. Additionally, an un-negligible issue has been detected in the survey. 65.5% students thought that "since I am very interested in GBL, if most classmates do not want to join, I would not really take part in GBL", which suggesting the great majority of students have the herd mentality toward GBL. Thus, full mobilization before

GBL implementation is extremely important. But above all, “*no suitable game type*” was believed to be the greatest potential barrier to use of GBL.

Therefore, we studied the genres of favorite serious games to find out suitable game type for future GBL. According published researches<sup>1,2,8-14</sup> and the familiarity of Chinese students to the game type, 7 serious games including board game, guessing game, role-play, the contest for knowledge, crossword puzzles, singleplayer online game and drug names solitaire were involved in the survey. Although “Bingo”<sup>6</sup> and “Jeopardy”<sup>3,9-12</sup> style games were effective in GBL, they were not selected because Chinese students are unfamiliar with these games. In terms of Chinese culture, whereas, guessing game<sup>2</sup> and drug names solitaire, which is a team building game competing in remembering drug names adapted from traditional Chinese game of words - Idioms Solitaire, were alternatives. Besides, the contest for knowledge, which allows two teams of students to compete in answering questions, is the most familiar format of serious game which was occasionally used in Chinese elementary and middle school. While students reported the most popular game genres were role-play, singleplayer online games, and crossword puzzles. This result suggests that students may have an affinity for cognitively challenging games in which competition is not intensive. Role playing games have special educational utility to help students envision their real-life scenarios life in professional practice without real-life consequences. Allowing students to step into the shoes of pharmacists or other pharmacy practitioners in an immersive and authentic way, could help to prospectively inform their decisions regarding which career choices would be the best fit with their values and personal characteristics. And we have gained experience of role-play organizing.<sup>2</sup> Thus, this game genre has a relatively high feasibility and of important values in generalization and application for future pharmaceutical GBL. Additionally, we found there is some difference among students of different grades. The first-year students are relatively in favor of board game; while singleplayer online games are welcomed by advanced students. However, each of other game genres was preferred by at least 10.7% students, suggesting the pharmacy students’ favorite game type is diversiform. Therefore, GBL should be operated in various ways, and the favorite game types would be blended together in the creation of serious games for GBL.

Concerning the most preferred time, normal class time or extracurricular activity can be used to implement GBL according to the game type. For example, some simple games would be interspersed in classroom teaching to teach core content to students, while great games can be organized as extracurricular activities to review,

consolidate and expand classroom knowledge using the extra time. However, the break between classes, which the teachers consider to be suitable for GBL, was not welcome by students. In our past experience, professional teachers were the organizers of GBL.<sup>1,2</sup> In the process, the extensive time investment was required by faculty members in creating and implementing the games and proctoring students,<sup>16</sup> has therefore a negative impact on educators’ willingness to use games.<sup>20</sup> And it is possible that, due to the age gap, GBL organized by faculty members do not always catch the fancy of the students. In this survey, however, the best organizer in the eye of the students unexpectedly is themselves, and the teachers are not quite as welcome as we imagine, suggesting Chinese pharmacy students have the sense of independence which needs supporting and accepting from the educators. Thus, we should find a better way to arouse the students’ enthusiasm to organize GBL, which helps to both the improvement of the students’ organizing ability and the generalization of GBL.

In assessing for gender differences, we found males were more interested in GBL, while females worried more. Thus more females wanted to become minor participants or audiences. These results indicate that Chinese male students are more open to the ideas and theories supporting alternative forms of teaching methods than female students, and they have more of a tendency to accept GBL than female students, while female students may have a more conservative opinion. Unexpectedly, when we compared the response of students favoring GBL implantation model including game type, implementing time and organizers, no statistically significant gender differences were elucidated. Pronounced male-female difference was found in student attitudes toward video games in medical education.<sup>21</sup> And the strong female preference was for puzzle games. Other games such as role-playing games showed a great male-female rift.<sup>21</sup> But it seemed that this gender difference is not remarkable in Chinese pharmaceutical GBL implementation.

## CONCLUSION

Chinese pharmacy undergraduates’ attitudes toward GBL in pharmaceutical education were positive, and a significant percentage of students would like to take part in GBL, suggesting GBL is a well-accepted means of pharmaceutical education in China. Male students generally had a more positive attitude toward GBL than female students. Pharmacy students attached GBL importance to “*improving the theoretical knowledge*”, “*increasing self efficacy*” and “*enhancing awareness of the career in future*”. Among several barriers to GBL usage, “*no suitable game type*” was considered the most

important. By analyzing the favorite game genres in GBL, we were able to conclude that the three most popular were role-play, singleplayer online games, and crossword puzzles, and no gender difference was found in this item. However, the pharmacy students' favorite game type is diversiform because each of other game genres was preferred by at least 10.7% students, suggesting GBL should be operated in various ways. Besides, most students reported that they were in favor of implementing GBL in normal class time or extra-curricular activity. And the best organizer in the eye of the students unexpectedly is themselves suggesting the sense of independence. Nevertheless, some of the un-negligible issues have been detected in the survey, including that the great majority of students have the herd mentality toward GBL, and wants to become the minor participants or audiences in the GBL. Thus it is of concern for educators to encourage the students' courage, self-expression and self-direction in Chinese pharmacy undergraduate education.

## ACKNOWLEDGEMENTS AND DECLARATION OF INTEREST

This research has been financially supported by Humanities and Social Science Foundation from Hubei province ministry of education (13q015). There is no conflict of interest for the present communication.

## REFERENCES

- Wang J, Hu X, Xi J. Guessing games in pharmacological teaching in China. *Med Educ* 2011; 45:1141–2.
- Wang J, Hu X, Xi J. Cooperative learning with role play in Chinese pharmacology education. *Indian J Pharmacol* 2012; 44:253–6.
- Tina Bayer-Hummel RN. The effects of Jeopardy as a test preparation strategy for nursing students. *Teaching and Learning in Nursing* 2010; 5:12–15.
- Telner D, Bujas-Bobanovic M, Chan D, et al. Game-based versus traditional case-based learning: comparing effectiveness in stroke continuing medical education. *Can Fam Physician* 2010; 56:345–51.
- Mangold K. Educating a new generation: Teaching baby boomer faculty about millennial students. *Nurse Educ* 2007; 32:21–3.
- Tietze KJ. A bingo game motivates students to interact with course material. *Am J Pharm Educ* 2007; 71:79.
- Rose TM. A board game to assist pharmacy students in learning metabolic pathways. *Am J Pharm Educ* 2011; 75:183.
- Wissmann JL, Tankel K. Nursing students' use of a psychopharmacology game for client empowerment. *J Prof Nur* 2001; 17:101–6.
- O'Leary S, Diepenhorst L, Churley-Strom R, Magrane D. Educational games in an obstetrics and gynecology core curriculum. *Am J Obstet Gynecol* 2005; 193:1848–51.
- Webb TP, Simpson D, Denson S, Duthie E Jr. Gaming used as an informal instructional technique: effects on learner knowledge and satisfaction. *J Surg Educ* 2012; 69:330–4.
- Khan MN, Telmesani A, Alkhotani A, Elzouki A, Edrees B, Alsulimani MH. Comparison of jeopardy game format versus traditional lecture format as a teaching methodology in medical education. *Saudi Med J* 2011; 32:1172–6.
- Shiroma PR, Massa AA, Alarcon RD. Using game format to teach psychopharmacology to medical students. *Med Teach* 2011; 33:156–60.
- Sward KA, Richardson S, Kendrick J, Maloney C. Use of a Web-based game to teach pediatric content to medical students. *Ambul Pediatr* 2008; 8:354–9.
- Shah S, Lynch LM, Macias-Moriarity LZ. Crossword puzzles as a tool to enhance learning about anti-ulcer agents. *Am J Pharm Educ* 2010; 74:117.
- Patel J. Using game format in small group classes for pharmacotherapeutics case studies. *Am J Pharm Educ* 2008; 72:21.
- Barclay SM, Jeffres MN, Bhakta R. Educational card games to teach pharmacotherapeutics in an advanced pharmacy practice experience. *Am J Pharm Educ* 2011; 75:33.
- Chen AM, Plake KS, Yehle KS, Kiersma ME. Impact of the geriatric medication game on pharmacy students' attitudes toward older adults. *Am J Pharm Educ* 2011; 75:158.
- Uhles N, Weimer-Elder B, Lee JG. Simulation game provides financial management training. *Healthc Financ Manage* 2008; 62:82–8.
- Aki EA, Mustafa R, Slomka T, Alawneh A, Vedavalli A, Schünemann HJ. An educational game for teaching clinical practice guidelines to Internal Medicine residents: development, feasibility and acceptability. *BMC Med Educ* 2008; 8:50.
- Blakely G, Skirton H, Cooper S, Allum P, Nemes P. Use of educational games in the health professions: a mixed-methods study of educators' perspectives in the UK. *Nurs Health Sci* 2010; 12:27–32.
- Kron FW, Gjerde CL, Sen A, Fetzters MD. Medical student attitudes toward video games and related new media technologies in medical education. *BMC Med Educ* 2010; 10:50.