

Game Theory-Based Community Square Fitness Activities Development Research

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Abstract: With development of Chinese economy and encouragement of nation's public fitness several polices, as well as the increasingly improvement of people's living standards, people's demands on living quality and style are getting higher and higher, people's desire for health also becomes more and more intensified, government cannot fully provide good entertainment venues for people in some regions, which needs to make proper distribution on their entertainment and rest time. The paper mainly carries out statistical analysis and corresponding organization according to current investigation results and relevant documents literature, clearly presents current community square dance development status and "non-dancing group" choices on fields and time to proceed with game analysis, gets that when both of them entertain and rest should consider each other then they can harmonious develop. So that meet different groups of people choices on different way of entertainment and better implement public fitness.

Keywords: Community square, fitness activities, game theory, nash equilibrium.

1. INTRODUCTION

Community square's fitness activity as one of important fields in public services, it always mainly relies on government supplying in China that leads to public cultural services levels always cannot achieve public satisfactory. Thereupon, nation regulates a series of policies concerning developing public cultural services as Table 1 [1].

With development of Chinese economy and nation's several polices on public fitness, as well as the increasingly improvement of people's living standards, it let people's demands on living quality and style to be higher and higher, people's desire for health also to become more and more intensified, government cannot fully provide good entertainment venues for people in some regions, which needs to make proper distribution on their entertainment and rest time, due to dancing groups have spontaneity, convenience, randomness these features in community, it leads to them mainly take sports fitness exercises major in self-organization and entertainment [2].

Community square dance initially was self-organized by members of housing estates, and a kind of fitness activity with the purpose of entertainment, in the beginning the fields they chose were mainly in some spaces of public parks and housing estates. With the development of era, groups that dancing square dance also grew strong, their demands on types of music of square dance increased, and demands on movement elements also became various, limitations in participating in activities also correspondingly decreased, and adaptations of participating in activities also correspondingly strengthened.

2. MODEL ESTABLISHMENT

Game theory mainly researches on interaction of formulation between incentive structures. Regard decisions every time is rational is a mathematical theory and method to study on phenomena that are of fighting spirits or competitiveness properties [3]. Game theory considers predicted behaviors and actual behaviors of one party of both parties in game, and studies their optimization strategies. Their game is as choices when playing chess, as Fig. (1)'s the game of choice [4].



Fig. (1). The game of choice.

By game theory analysis, it gets that square dance fitness activity time selection's optimal mode, its process is as following: assume that there are two types of departments that affect square dance fitness activity selecting on time, one type is "dancing group", the other is "other groups in housing estates", both of them can make selection of "rest and entertainment" the two choices [5]. First case, it is up to "dancing group" selects entertainment why "other groups in housing estates" select rest, "dancing group" can get benefits Q_{w1} that records it as "10", now subjects of "other groups in housing estates" cannot directly get benefits from the

Table 1. Nation’s polices on public cultural services.

Year	Nation’s Policies
2000	The State Council issued “State Council’s notice about several economic policies supporting cultural undertakings development”, and published a series of fiscal preferential policies, and worked on supporting propagandizing cultural undertakings.
2002	The 16 th National Congress of CPC clearly presented “Positive develop cultural undertakings and cultural industries”, “deepen cultural system reformation”
2003	The 16 th Plenary Session clearly brought cultural system reformation into important tasks of perfecting socialist market economy, further defined overall thoughts and objective of deepening cultural system reformation.
2004	The Fourth Plenary Session of Sixteenth Central Committee regarded improving construction on socialist advanced cultural ability as one of important tasks of strengthening party’s governing ability construction, clearly presented to deepen cultural system reformation, emancipate and develop productive forces.
2005	The Fifth Plenary Session of Sixteenth Central Committee emphasized to construct public cultural services system.
2006	“The outline of nation’s the eleventh five year period cultural development planning” presented to establish strategies of making China stronger by nation’s cultural development.

Table 2. Community fitness dance participation forms.

Forms of Participating in Activities	Join Alone	With Friends Accompany	With Family Accompany	Total
Frequency	378	42	83	500
Percentage	75.60%	8.30%	16.60%	100%

selection, earnings are recorded as “0”; Second case, decision makers of “other groups in housing estates” decide to entertain, while “dancing group” selects to rest, now benefit clusters of “other groups in housing estates” can get benefits Q_{m1} from entertainment that is recorded as “10”, because when “other groups in housing estates” entertain, it affects “dancing group” normal entertainment, “dancing group” can get benefits Q_{w2} from public cultural consumption that is recorded as “0”; Third case, both decision makers from “dancing group” and “other groups in housing estates” decide to entertain, then both “dancing group” and “other groups in housing estates” are affected when they entertain, so “dancing group” gets benefits Q_w from them that is recorded as “6”, benefit clusters from “Other groups in housing estates” get benefits “ Q_m ” from them that is recorded as “6”; Fourth case, both decision makers from “dancing group” and “other groups in housing estates” decide not to entertain, both of them don’t get benefits, both earnings are recorded as “0”.

“Dancing group” benefit matrix optimal benefit is closed by circles; “other groups in housing estates” benefit clusters benefit matrix optimal benefit is closed by boxes [6].

Table 2 is combination of two game parties’ benefit matrixes, the result can also become benefit tables that “dancing group” and “other groups in housing estates” strategies making. “Dancing group” benefit status is written in left bottom corner of the table, and “other groups in housing estates” benefit status is written in top right corner

of the table. For instance, “10” is in the left bottom corner of top right corner’s cell, which is “dancing group” benefit when both “dancing group” and “other groups in housing estates” select to supply.

Estimate according to figures of benefits, furthermore, Table’s benefits exact figure normally is not important, because our interests are mainly strategies problems that are hidden in benefit table.

When it occurs to “third case”(common entertainment), due to public square dance fitness event itself has public characters, when commonly entertaining, it surely will affect “other groups in housing estates” entertainment activities. When it occurs to “first case” (only “dancing group”), now “dancing group” can get maximum benefits, but it surely will affect “other groups in housing estates” regular life in this way, and they surely will protect their benefits. Optimal benefit matrix (maximum earnings) is still “third case” (common entertainment). Therefore we assume $Q_w > Q_{w1} > Q_{w2}$. But Q_m and Q_{m1} relationships are not defined. So it lists new benefits joint matrix.

Due to the size and relationships between Q_m and Q_{m1} are not definite, it needs us to look for whether it has mixed strategy equilibrium.

Assume that probability when “Dancing group” selects to entertain is p , then probability when selecting not to entertain (and rest) is $1-p$; assume that probability that “other groups in housing estates” select to supply entertainment is q , then probability when selecting not to

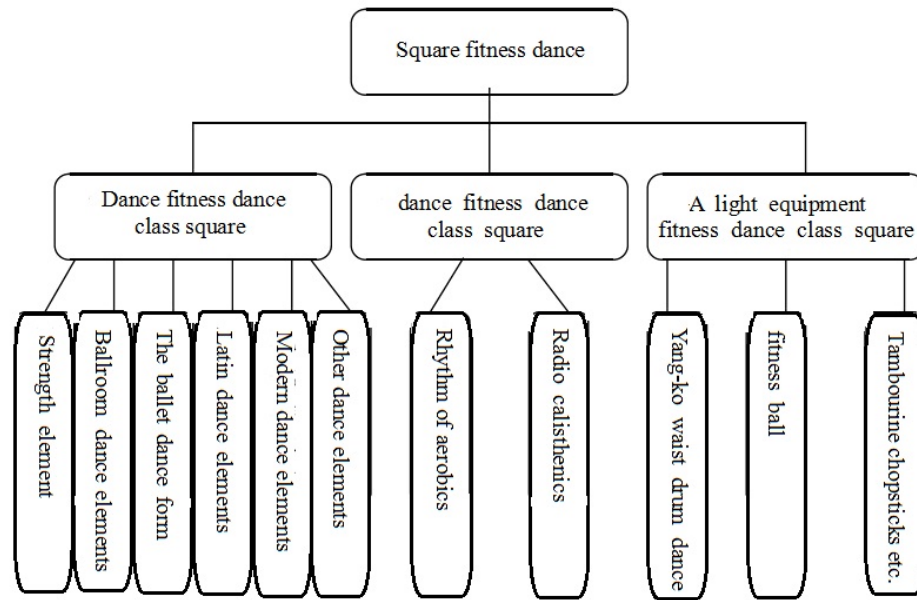


Fig. (2). The community square dance forms.

entertain (and rest) is $1 - q$. According to methods of solving mixed strategy:

Discuss on “dancing group” selection, it has:

$$qQ_w + (1 - q)Q_{w1} = qQ_{w2}, \text{ then: } q = \frac{Q_{w1}}{Q_{w1} - (Q_w - Q_{w1})} > 1$$

Discuss on “other groups in housing estates” selection, it has:

$$pQ_m + (1 - p)Q_{m1} = 0, \text{ then } q = \frac{Q_{m1}}{Q_{m1} - Q_m} > 1$$

Because $0 < p < 1, 0 < q < 1$, two parties choices don't have mixed strategy equilibrium.

But due to there is no absolute rational choice in people's real life, and when “dancing group” and “other groups in housing estates” make strategies, select whether to entertain or rest, they are constantly repeating and dynamic changing. In some senses, when “dancing group” and “other groups in housing estates” make strategies, their selection actually is a procedure of “testing fault”, in most case, use evolution game tools to study selected strategies when “dancing group” and “other groups in housing estates” make strategies that more conforms to practical situations.

Since China launched “public fitness plan”, national fitness consciousness has generally improved, correspondingly developed community square fitness activities have also gradually increased, dancing groups that participated in square dance have gradually grown strong, public fitness fever has been spread in whole China. Hereupon, government also built multiple public fitness centers, as senior centers, park inside downtown and housing estates squares, which gradually becomes one part of people's entertainment. In the following, it carries out analysis of community square dance activity status, and gets its present development status.

2.1. Community Square Dance Development Level

At first, it analyzes community square dance presentation as Fig. (2).

From Fig. (2), we can get that present community square dance mainly divides into three blocks, from which it includes dance fitness dance class square fitness square, gymnastics and dance class square fitness dance and a light equipment class square fitness dance.

Then analyze community fitness dance participation forms as Table 1.

Correspond to above data, it draws “Black-white bar figure” as Fig. (3).

From above analysis, it is clear that present community square dance fitness groups of people's forms of participating in square dance are mainly joining alone that occupies 75.60% of totality, only 8.30% groups of people participates in with friends, and 16.60% groups of people participate in with family.

Finally, it analyzes community square dance participants' frequency of participating and activities venues as Table 2 Community square dance activities' frequency of participating and Table 3 Square fitness dance activity venues.

Correspond to above data, it draws “black-white pie figure” as Fig. (4).

From above analysis, it is clear that frequency of participating in community square dance concentrates on 3 to 5 times per week that occupies 57.80% of totality, secondly is dancing square dance every day or almost every day that occupies 31.7% of totality, only 10.50% people are going to dance 1 to 2 times per week.

Community square dance fitness activities venues selection is as Table 4.

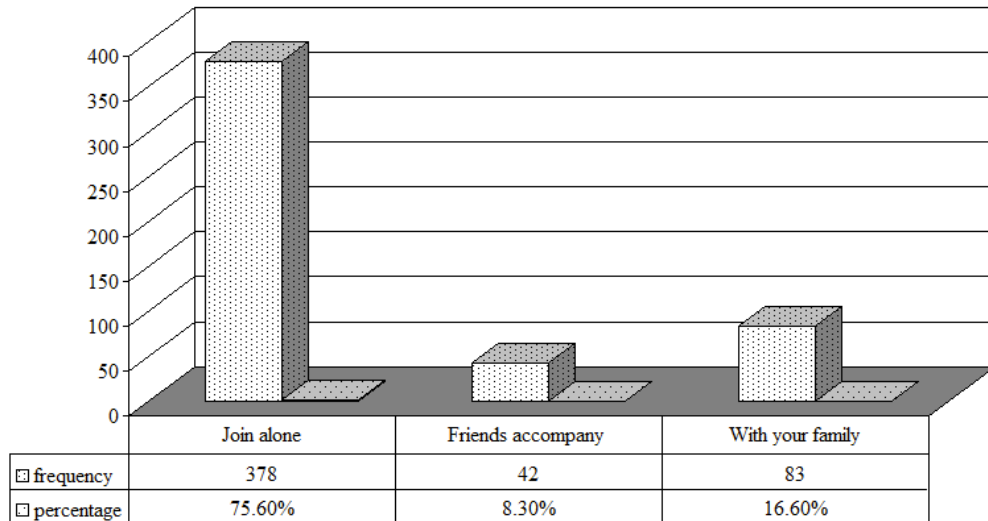


Fig. (3). The community fitness dance in form.

Table 3. Community square dance activities' frequency of participating.

Frequency of Participating	1-2 Times Per Week	3-5 Times Per Week	Every Day or Almost Every Day	Total
Number of people make selection	52	289	159	500
Percentage	10.50%	57.80%	31.70%	100%

Table 4. Square fitness dance activity venues.

Activity Venues	Residential Space	Community Square	Park	Along Street	Sports Venues	Total
Number of people make selection	117	235	100	28	20	500
Percentage	23.50%	47%	20%	5.50%	4%	100%

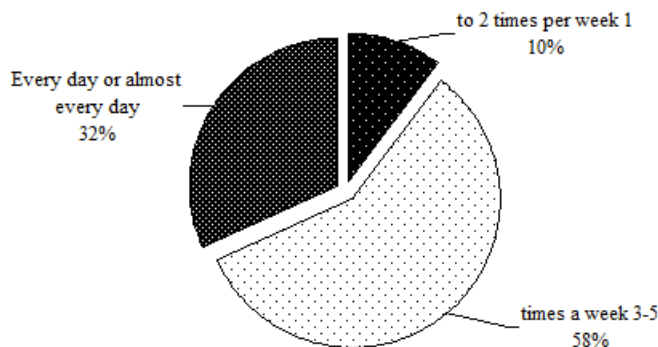


Fig. (4). Community participation frequency square dance activities.

Correspond to above data, it draws “black-white bar figure” as Fig. (5).

From above analysis, it is clear that community square dance fitness activities sites mainly concentrate on community square that occupies 47.0% of totality secondly is residential space that occupies 23.50% of totality.

2.2. Community Square Dance Influences

Firstly make analysis of square dance influence factors as Table 5.

Correspond to above data, draw “pie figure” as Fig. (6).

From above analysis, it is clear that site facility is regarded as maximum influence factor by “dancing group” that occupies 27% of totality, second is less free time that occupies 20% of totality, the least influence is community organization that occupies 3% of totality.

Then make analysis of community square dance participants' age distribution and education background, as Table 6 participants' age distribution.

Correspond to above data, it draws “bar figure” as Fig. (7).

According to above analysis, age group of groups of people that dancing square dance mainly distributes between 45 and 59 years old that occupies 45%, groups of people that below 30 years old and above 75 years old added proportion are only 11%.

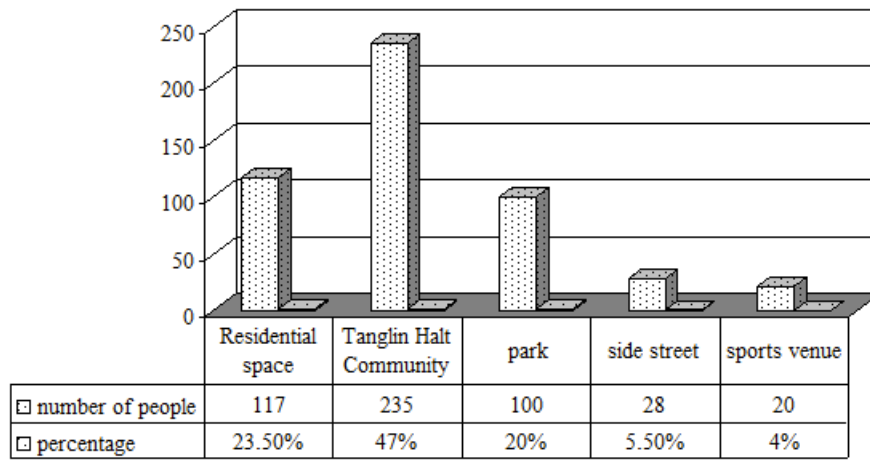


Fig. (5). Square fitness dance event venues.

Table 5. Square dance influence factors.

Influence Factors	Number of People Make Selection	Percentage
Site facility	135	27%
Presence of instructor or not	25	5%
Practice content	45	9%
Practice effect	75	15%
Exercise atmosphere	50	10%
Friends and family influence	55	11%
Free Time	100	20%
Community organization	15	3%
Total	500	100%

Table 6. Age distribution of square dance participants.

Education Background	Number of People Make Selection	Percentage
Primary school	70	14%
Junior high school	125	25%
Technical secondary school or high school	225	45%
Junior college	40	8%
Regular college course	30	6%
Graduate or above	10	2%
Total	500	100%

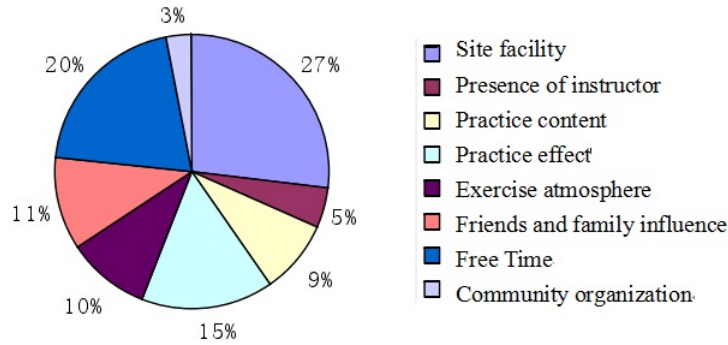


Fig. (6). The influence factors of square dance.

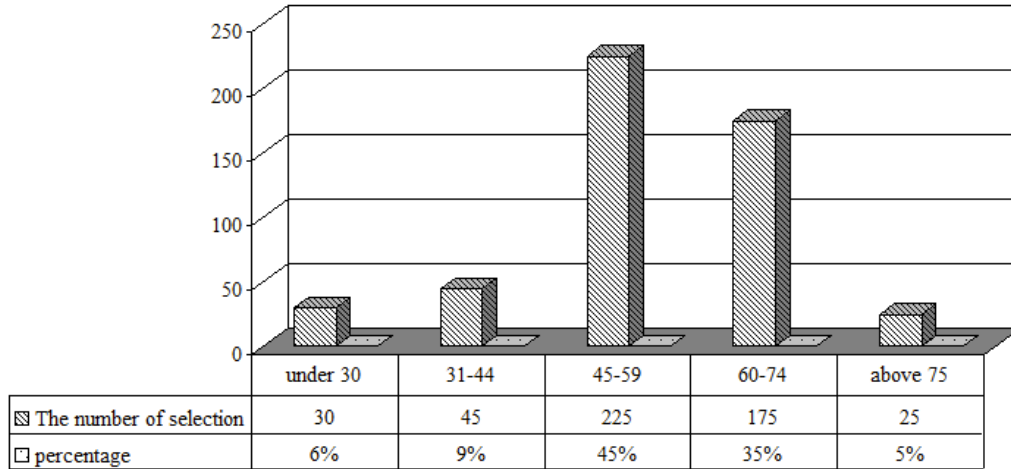


Fig. (7). Participate in the square dance.

Table 7. Dancing group’s education background distribution.

Education Background	Number of People Make Selection	Percentage
Primary school	70	14%
Junior high school	125	25%
Technical secondary school or high school	225	45%
Junior college	40	8%
Regular college course	30	6%
Graduate or above	10	2%
Total	500	100%

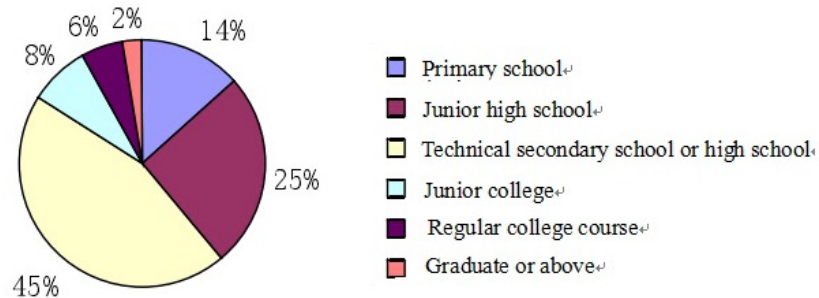


Fig. (8). Dance cultural degree distribution of the population.

Then make a survey on square dance participants' education background, its result is as Table 7.

Correspond to above data, it draws "pie figure" as Fig. (8).

CONCLUSION

The paper mainly carries out statistical analysis and corresponding organization according to present investigation results and relevant document literature, clearly presents current community square dance development status and "none-dancing group" selection on venues and time to make game analysis, and gets that when both of them entertain and rest should consider each other, then can harmonious develop. So that meet different groups of people choices on different way of entertainment and better implement public fitness.

In these aspects, government should support basic cultural construction, do well in relevant planning, let culture and economy to develop rapidly and meanwhile focus on community square dance fitness the type of masses self-organized entertainment fitness activities, especially for properly laying out housing estates construction and population residential status, leave sufficient fitness venues and activities space for people so that can harmonious develop and avoid some unnecessary disputes.

CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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