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Impact of Music Education for the Elderly on Depression and Sleep Quality

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Abstract: *Elder retirement volunteers, as the major manpower source of various organizations, not only present rich experiences and abundant working hours, maintain traditional rules, and cherish service opportunities, but also enjoy playing altruistic roles. For this reason, understanding elder volunteers' participation motivation and enhancing the job satisfaction to promote the intention of continuous service could avoid the loss of elder volunteers. Aiming at elder volunteers of Hunan Volunteers Association, total 300 copies of questionnaire are distributed for this study and total 226 valid copies are retrieved, with the retrieval rate 75%. The research results reveal significant positive effects of 1.participation motivation on happiness, 2. happiness on intention of continuous participation, and 3.participation motivation on intention of continuous participation. Meantime, support vector machine (SVM) is used to collect the behavior data of the elderly and preprocess the data with K-means. Then, it is applied to analyze and classify the characteristic data, and then match with the indicators to enhance the happiness of elderly volunteers. According to the results, suggestions are proposed in this study, expecting to encourage and maintain elder retirees' continuous service by the participation motivation and the enhancement of volunteer happiness to further promote the service efficiency of organizations, under current manpower shortage.*

Keywords: *elder volunteer, participation motivation, happiness, intention of continuous participation*

1. Research motivation

Modernized democratic countries stress on the quality of life and enhance the living happiness of the citizens. In a democratic, free, and economically prosperous society, the citizens have residual strength, time, and mind to concern about others and emphasize the pursuit and realization of self-goals merely when they live under richness and stability. A democratic society not only allows and encourages the citizens engaging in various activities according to their willingness to cultivate the spontaneity, but also has the members acquire the satisfaction with self-growth in the cooperation process. In this case, the more prosperous social economy appears in a democratic country, the more people would voluntarily participate in social services (Chen et al., 2011) [1]. On the other hand, there are more increasing citizens participating in public affairs and voluntary service when people in a democratic country enhance the autonomy and the government encounters financial difficulty under the rapidly changing society. Retirement volunteers present rich experiences and abundant working hours, maintain traditional rules, cherish service opportunities, and are fond of playing altruistic roles. Such retired elderly therefore could reduce the burden of personnel expenses in an organization, when they could contribute the wisdom and experiences as well as participate in social services. Besides, retirees as volunteers to develop the specialty could reduce the sense of loss caused by not working to achieve win-win (Deery et al., 2011) [2]. Chinese Taiwan has currently stepped in an aging society, and retirement volunteers gradually become the major manpower source of volunteers in institutions. Volunteer management is different from salaried personnel. The relationship between volunteers and management sectors can be sustained merely when both parties are satisfied. As the artificial intelligence technology develops continuously, human-computer interaction has also played a greater role in many fields, especially SVM, which has achieved good results in the field of information collection and classification. For this reason, it becomes a research issue to encourage and maintain retirees' participation motivation, happiness, and participation in continuous service to further promote the service efficiency of organizations.

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2. Literature and hypothesis

2.1 Participation motivation

Kim et al. (2015) indicated that motivation came from some needs not being satisfied; such needs might be resulted from physiology, or driving force, which generally existed in human properties with heredity [3]. Walters (2013) pointed out motivation as the intention to engage in certain work, depending on the satisfaction with personal needs after completing the work [4]. Diener & Chan (2011) regarded motivation as an inner process to induce individual activity, maintain induced activity, and guide such activity towards certain objective [5]. Wang & Ashcraft (2014) proposed three characteristics of motivation, namely (1)being initiated before actions, (2)being a continuous inner process, and (3)being able to induce an individual towards certain objective to perform explicit behaviors [6]. From the definitions of motivation, Hyun (2013) discovered that motivation was the psychological process in an individual and was induced by the individual intending to satisfy certain needs; the behaviors were the explicit performance of the inner needs. Accordingly, motivation is defined in this study as the inner psychological process of an individual being affected by internal and external environments and intending to satisfy or achieve certain needs before actions. Motivation could induce individual behaviors to continue. Individual motivation could be judged and observed by the external behaviors that the stronger motivation shows the higher ability to satisfy the needs. Jiranek et al. (2013) regarded diversified motivation as the general pattern of volunteer participation. Chou Wen-ti, the ex-president of American Volunteering Scholar Association, indicated that motivation was diversified and the commonest pattern of volunteer [7]. In current democratic societies, volunteers participating in voluntary service therefore are no longer a charity business or altruistic behaviors; diversified participation motivation will be the characteristic of volunteers participating in voluntary service.

Chen et al. (2011) analyzed the motive of volunteers participating in voluntary service and divided the general volunteer participation motive into three types of directedness[1].

(1) Self-directed: Such volunteers determine to participate in voluntary service based on personal feelings, judgment, and value. In other words, the deciding factors in volunteers participating in voluntary service come from individual inner that it is called inner-directedness. In such directedness, the major motive to participate in voluntary service contains service and responsibility, feedback to society, and self-realization.

(2) Other-directed: Such volunteers determine the participation in voluntary service by others' influence. In such directedness, the major motive to participate in voluntary service is based on interpersonal relationship, the identification and rules of belonged teams (family, school, organization), and even the appreciation from relatives and friends by participating in voluntary service.

(3) Situation-directed: Such volunteers determine to participate in voluntary service by the social situation, including special factor of social change and the opportunity of individual participation in services. In such directedness, the convenience of service time, service location, and service opportunity matching with service needs and personal willingness is the motive of volunteers' participation.

2.2 Happiness

Kahana et al. (2013) regarded happiness as the overall thinking and evaluation of the quality of life to reflect the judgment of life satisfaction, and the final happiness was formed by the enhancement of positive emotion, the reduction of negative emotion, and the satisfaction with life [8]. Cornwell (2011) pointed out the characteristics of people with happiness, including positive emotion, enjoying participating in activity, being good at social relationship, good interpersonal relationship, being in favor of engaged activity, being good at controlling personal activity, viewing things from bright side, and high self-esteem [9]. A person with positive affect balance, i.e. experiencing large amount of pleasant emotion, little unpleasant or pain emotion, and satisfying with personal life, are regarded as those with rich subjective happiness (Pilkington et al., 2012)[10]. Vecina et al. (2013) indicated that the measurement of happiness relied on personal subjective awareness and the perception of events; different individual, according to various standards, would present distinct subjective perception so that happiness was often called subjective happiness [11]. Dwyer et al. (2013) regarded it as an inner experience to induce individual positive psychology through various media [12]. Accordingly, 9 categories of happiness are deducted, including satisfaction with esteem, harmonious interpersonal

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relationship, monetary pursuit, job achievement, optimistic attitudes towards life, living better than others, self-control and realization, temporary happiness, and demands for health. Kim et al. (2011) pointed out happiness as individual evaluation of job, family, leisure, health conditions, financial conditions, self-perception, and satisfaction with being in a team as well as the comprehensive evaluation of emotional experiences [13]. Robbins & Judge (2015) explained happiness as the response to life satisfaction or the perception of positive emotion frequency and strength [14]. Referring to the happiness scale compiled by Kim et al. (2015) [3], self-affirmation, life satisfaction, interpersonal relationship, and physical and mental health are the dimensions to measure happiness.

2.3 Intention of continuous participation

There has not been a certain definition about volunteers' continuous service. The definitions are discussed from the factors in continuous service.

(1) Voluntary service is the realization of personal growth and self-satisfaction. Voluntary service is a spontaneous behavior. When volunteers receive satisfaction and achievement from the service process, the intention of continuous service would be largely enhanced. By holding volunteer training courses, volunteers in an organization could learn professional service skills and knowledge and acquire the opportunity to participate in learning (Hayes, 2012)[15].

(2) Voluntary service is the planning of personal leisure time. In comparison with past societies, the leisure time is increased. It becomes an objective for modern people effectively planning leisure time and engaging in meaningful leisure activity. When voluntary service becomes a new-generation leisure activity, it could benefit individuals physiologically and psychologically as well as help the balanced development of society (Kahana et al., 2012)[16].

(3) Confirmation of voluntary service contents could enhance the promotion of social welfare. Increasing social problems have driven government institutions' emphases on social welfare. While various social welfare and policies are practiced, voluntary service present the legality and definition through the government's legislation and policy making so that there is reference for dealing with voluntary service (Kwok et al., 2013)[17].

(4) Voluntary service is personal perception of the volunteer organization. Volunteers' identification to the organization would affect the intention of continuous service. Volunteers have encountered several problems and trouble in the service process, such as competition among volunteers and bad communication between organization staff and volunteers, which would reduce volunteers' intention of continuous service (Ranzijn, 2011)[18].

Apparently, the egoistic and altruistic benefits in the voluntary service are the key of volunteers intending to continuously participate in voluntary service. In this case, the key factor in the intention of continuous participation is volunteers' perceived satisfaction with voluntary service in an organization. Volunteers receiving high satisfaction in the voluntary service would enhance the centripetal force and promote the intention of continuously participating in voluntary service. Referring to Lee et al. (2014), participation intention, participation degree, and intention to stay are the dimensions to measure volunteers' intention of continuous participation.

2.4 Study on the relationship between participation motivation and happiness

Mannino et al. (2011) pointed out the significantly positive correlations between yoga participants' participation motivation and happiness as well as the remarkable correlations among participation motivation, leisure benefits, and happiness[19]. Hayes (2013) indicated the notable correlations between association participation motivation and happiness of elementary high graders as well as the predictive power of participation motivation of pupils in different types of associations to happiness [20]. Ranzijn (2011) revealed the remarkably positive correlations between morning exercisers' participation motivation and life satisfaction and positive emotion in happiness [18]. Most above research shows notably positive correlations between participation motivation and happiness, i.e. the higher participation motivation, the higher happiness. The following hypothesis is therefore proposed in this study.

H1: Participation motivation presents significantly positive effects on happiness.

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2.5 Study on the relationship between happiness and intention of continuous participation

Robbins & Judge (2015) discovered that ones with stronger altruistic motivation and higher general satisfaction and growth satisfaction appeared lower turnover intention; however, those with stronger social responsibility motivation presented higher turnover intention [14]. Keeran & Levine-Clark (2014) concluded that volunteers' "participation motivation" and "happiness" could effectively predict the "intention of continuous service" [21]. Walters (2013) proposed that volunteer parents' "participation motivation" and "happiness" could effectively predict the intention of continuous service [4]. McShane & Von Glinow (2014) pointed out the stronger "happiness", the higher "intention of continuous participation" and "organizational commitment" [22]. Wang & Ashcraft (2014) indicated the significant predictive power of "participation motivation" and "happiness" to "intention of continuous service". The following hypothesis is then proposed in this study [6].

H2: Happiness shows remarkably positive effects on intention of continuous participation.

2.6 Study on the relationship between participation motivation and intention of continuous participation

With Regression Analysis, Khan et al. (2011) pointed out the remarkably positive effects of volunteers' participation motivation and sense of community on the continuous service, revealing the higher volunteers' participation motivation and sense of community, the higher intention of continuous service; besides, volunteers' participation motivation presented notably positive effects on the sense of community [23]. Vecina et al. (2013) indicated that volunteers' "participation motivation" and "job satisfaction" could effectively predict the "intention of continuous service" [11]. Nencini et al. (2015) proved that volunteer parents' "participation motivation" and "job satisfaction" could effectively predict the intention of continuous service [24]. Lee et al. (2014) concluded that the stronger retirement volunteers pursued "organizational climate satisfaction" and "self-participation motivation", the higher intention of continuous service would appear. The following hypothesis is further proposed in this study [25].

H3: Participation motivation reveals notably positive effects on intention of continuous participation.

3. Sample and measuring index

3.1 Research sample and subject

Elder volunteers of Hunan Volunteers Association therefore are selected as the research subjects. Total 300 copies of questionnaire are distributed, and 226 valid copies are retrieved, with the retrieval rate 75%. Hunan Volunteers Association was established in December 5, 1993, it is sponsored by the municipal corporation. There are large-scale activities of voluntary service, poverty alleviation plan, voluntary action and long-term services, community "CARE", youth legal aid, youth Starlight self-protection, anti-drug publicity and other volunteer service activities in the whole society have a broad and positive Impact.

3.2 Test of reliability and validity

Validity refers to a measuring tool being able to actually measure the problems which a researcher would like to measure. Validity is generally divided into content validity, criterion-related validity, and construct validity. Since the questions in the questionnaire are referred to domestic and international research and a pretest has been preceded before the formal questionnaire, this study therefore presents certain content validity. Participation motivation, happiness, and intention of continuous participation in this study are tested the causal relationship with Linear Structural Relation Model. The data input is based on the correlation coefficient matrix of above variables. The Linear Structural Relation Model analysis reveals the overall model fit achieving rational range that it shows favorable convergent validity and predictive validity. According to the suggestion of Kerlinger (1986), item-to-total correlation coefficients are used for testing the construct validity of the questionnaire content. In other words, the reliability analysis is utilized [26]. The calculated item-to-total correlation coefficients are used for judging the questionnaire content. The item-to-total correlation coefficients of the dimensions in this study are above 0.7, revealing certain construct validity of the dimensions in this questionnaire.

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T questionnaire is analyzed the reliability and validity. Based on the standard, the developed formal questionnaire presents the Cronbach's α reliability coefficient in the reliability range of 0.73~0.87.

3.3 Support vector machine (SVM)

SVM is a classification model, which collects data through wireless sensors, defines data time with sliding window, and extracts data features. The sliding window is set to 2 seconds and the sampling rate is 100Hz. According to the research of Kong et al. (2019) [27], sensors are used to collect emotional data of the elderly, and K-means algorithm is adopted to preprocess the data to eliminate the "noise" points and isolated points. According to the research of Phyo et al. (2019)[28], when extracting data features, it is necessary to continuously transform the original data to obtain the data mean, variance, standard deviation, maximum value, minimum value, and correlation coefficient.

These data can further show the relationship between the data in the feature statistics, and better reflect the data situation. Suppose that the sample data is $X=\{x_1,x_2,x_3,\cdots,x_n\}$, $\{x_1,x_2,x_3,\cdots,x_n\}\in R^n$, in which there are N data, so the mean value can be calculated by equation (1).

$$Mean=\frac{1}{N}\sum_{i=1}^{N}x_i \tag{1}$$

The corresponding variance, standard deviation, maximum value, minimum value, and correlation coefficient are calculated as shown in equations (2) to (6).

$$Variance=\frac{1}{N}\sum_{i=1}^{N}\left(x_i-\mu\right)^2 \tag{2}$$

$$S\tan dardDeviation=\sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(x_i-\mu\right)^2} \tag{3}$$

$$Max=\max\left(x_1,x_2,x_3,\cdots,x_n\right) \tag{4}$$

$$Min=\min\left(x_1,x_2,x_3,\cdots,x_n\right) \tag{5}$$

$$r=\frac{\sum_{i=1}^{N}\left(X_i-\overline{X}\right)\left(Y_i-\overline{Y}\right)}{\sqrt{\sum_{i=1}^{N}\left(X_i-\overline{X}\right)^2}\sqrt{\sum_{i=1}^{N}\left(Y_i-\overline{Y}\right)^2}} \tag{6}$$

Where μ is the mean value of the sample. The correlation coefficient expressed in equation (6) is the Pearson product moment correlation coefficient, and the value range is [-1, +1]. When the correlation coefficient is closer to 0, it means that there is no correlation between the two groups of data. The closer the correlation coefficient is to +1 or -1, the stronger the linear inertia between the two groups of data is. $\overline{X}$ and $\overline{Y}$ represent the mean value of the corresponding samples, respectively.

The accuracy rate and recall rate are used to evaluate the indicators. The accuracy rate P can be expressed by equation (7).

$$P=\frac{TP}{TP+FP} \tag{7}$$

In equation (7), TP is the number of correct information extracted and FP is the number of false information extracted. The recall rate R can be expressed by equation (8).

$$R=\frac{TP}{TP+FN} \tag{8}$$

FN is the number of false information in the sample.

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4. Empirical analysis

4.1 Evaluation indicators of LISREL Model

LISREL (linear structural relation) Model combines Factor Analysis and Path Analysis in statistics and includes simultaneous equations in econometrics that it could simultaneously calculate multi-factor and multi-casual paths. Bagozzi & Yi (1988) suggested evaluating the model fit from preliminary fit criteria, overall model fit, and fit of internal structure of model [29].

The data in this study are organized in Table 1. The preliminary fit criteria, fit of internal structure, and overall model fit are explained as below.

In terms of preliminary fit criteria, Table 1, the three dimensions of participation motivation (self-directed, other-directed, situation-directed) achieve the significant explanation of participation motivation ($t>1.96$, $p<0.05$); the four dimensions of happiness (self-affirmation, life satisfaction, interpersonal relationship, physical and mental health) reach the significant explanation of happiness ($t>1.96$, $p<0.05$); and, the three dimensions of intention of continuous participation (participation intention, participation degree, intention to stay) achieves the significant explanation of intention of continuous participation ($t>1.96$, $p<0.05$). Apparently, the model presents good preliminary fit criteria.

In regard to fit of internal structure, participation motivation shows positive and remarkable correlations with happiness (0.896, $p<0.01$), happiness reveals positive and notable correlations with intention of continuous participation (0.872, $p<0.01$), and participation motivation presents positive and significant correlations with intention of continuous participation (0.857, $p<0.01$). H1, H2, and H3 are therefore supported, (see Table 2).

Regarding overall model fit, the overall model fit standards $\chi 2/Df=1.762$, below the standard 3, and RMR=0.006, reveal the appropriateness of $\chi 2/DF$ and RMR. Furthermore, chi-square value is sensitive to sample size that it is not suitable for directly judging the fit. However, the overall model fit standards GFI=0.966 and AGFI=0.921 are higher than the standard 0.9 (the closer GFI and AGFI to 1, the better model fit) that this model presents better goodness-of-fit indicators.

Table 1 Overall LISREL Model analysis

Evaluation item	Parameter/evaluation standard		Result	t
Preliminary fit criteria	Participation motivation	Self-directed α1	0.731	9.52**
		Other-directed α2	0.758	11.43**
		Situation-directed α3	0.742	10.37**
	Happiness	Self-affirmation β1	0.823	15.12**
		Life satisfaction β2	0.846	18.62**
		Interpersonal relationship β3	0.817	13.24**
		Physical and mental health β4	0.833	16.94**
	Intention of continuous participation	Participation intention σ1	0.874	21.37**
		Participation degree σ2	0.851	19.45**
		Intention to stay σ3	0.864	20.56**
Fit of internal structure	Participation motivation→happiness		0.896	36.29**
	Happiness→intention of continuous participation		0.872	33.41**
	Participation motivation→intention of continuous participation		0.857	31.58**
Overall model fit	X2/Df		1.762	
	GFI		0.966	
	AGFI		0.921	
	RMR		0.006	

Note: * stands for $p<0.05$, ** for $p<0.01$, *** for $p<0.001$.

Table 2 Hypothesis test

Research hypothesis	Correlation	Empirical result	P	Result
H1	+	0.896	P<0.01	Supported
H2	+	0.872	P<0.01	Supported
H3	+	0.857	P<0.01	Supported

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4.2 Impact trend

The data of daily life of the elderly were collected by sensors with a sampling rate of 0.03, and 1906 samples were collected from 226 volunteers. Therefore, 70% of the samples were taken as training set and 30% as test set. Among them, self-directed, other-directed and situation-directed, self affirmation, life satisfaction, interpersonal relationship, physical and mental health, participation intention, participation degree, and stay intention are the fitting conditions of participation motivation, happiness, and continuous participation intention obtained from factor analysis and path analysis. When training and testing these samples, the accuracy rate and recall rate are used to evaluate the classification prediction. After classifying the behavior characteristics of the elderly by using SVM and matching with the factors, the accuracy rate and recall rate of the above ten index factors are obtained, as shown in Table 3.

Table 3 Classification results of feature extraction test set by SVM

	Self-directed	Other-directed	Situation-directed	Self-affirmation	Life satisfaction	Interpersonal relationship	Physical and mental health	Prticipation intension	Participation degree	Stay intension	Mean accuracy
Accuracy rate	93.1%	84.3%	93.5%	94.2%	96.3%	91.7%	93.7%	90.1%	94.2%	89.7%	92.08%
Recall rate	93.2%	99.1%	88.3%	94.1%	96.3%	92.6%	93.5%	90.3%	94.3%	88.8%	93.05%

The above results suggest that the accuracy of the ten indicators is high, especially self affirmation, life satisfaction, and participation degree. Hence, the prediction of happiness of elderly volunteers is closely related to their own participation and experience.

Therefore, after preprocessing the collected data by using K-means, SVM can extract many feature data and classify them, and match with ten index factors. Furthermore, it is pointed out that there is a positive correlation among the participation motivation, continuous service, willingness of elderly volunteers, and happiness. Meanwhile, SVM can also be used to further predict the psychological state of the elderly through information features, thereby enhancing their sense of belonging and self-confidence.

5. Suggestion

According to the research results and findings, the following practical suggestions are proposed.

(1) The recruitment can focus on retirees who are married with children, present the education higher than colleges, have been government employees, and show good health conditions, as their happiness is obviously higher. Letters to schools and government sectors to encourage the participation of government employees or the recruitment notice in temples could be applied to recruit volunteers with higher job satisfaction and intention of continuous service and reduce the costs for recruiting and training new volunteers.

(2) From the research results, both participation motivation and happiness positively affect elder volunteers' intention of continuous service. Especially, participation motivation not only influences the willingness to stay, but also affects the happiness degree. Focusing on elder volunteers' psychology by planning various training courses for growth and allowing them developing the specialties in the service, satisfying the interests, and further acquiring self-affirmation could enhance the happiness and expect the continuous stay.

(3) Communicating with elder volunteers, understanding their expectation and demands for organizations, offering suitable training courses and proper service work, giving positive encouragement and affirmation, and timely evaluating and revising courses and rewards would promote elder volunteers' job satisfaction and increase the intention of continuous service.

6. Conclusion

The research results show remarkably positive correlations between elder volunteers' participation motivation and happiness and notably positive correlations between participation motivation, happiness and intention of continuous service. It reveals that ones with high participation motivation appear higher happiness and higher intention of continuous service after the participation. As a result, an appropriate elder volunteer management model, the intention to treat elder volunteers, corresponding to their expectation, and the creation of harmonious atmosphere could enhance the identification, intention of devotion, and willingness to stay. The use of SVM to collect, analyze, and classify the

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information features not only realizes the information interaction between artificial intelligence and the elderly, but also improves the accuracy of feature extraction in the analysis and classification work, and then completes the matching work with the factors, thus improving the accuracy of prediction. Moreover, those pursuing self-growth should be emphasized to increase the experiences and develop the specialties for attracting the participation of more elder retirement volunteers so as to recruit elder retirement volunteers. In this case, well utilizing elderly human resources could enhance volunteers' social belongingness, self-confidence, self-affirmation, and psychological satisfaction as well as assist in the practice of volunteers' environmental education with their rich life experiences.

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