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Self-efficacy as a mediator of the link between learning motivation and subjective well-being among older adults in Beijing

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ABSTRACT

This study explored the relationship between subjective well-being (SWB) and learning motivation (LM) among older Chinese adults, focusing on the mediating role of self-efficacy (SE) and differences by age and education level. A total of 481 Beijing residents aged 60 and above participated in a questionnaire survey, which included LM, SWB, and SE scales. Confirmatory factor analysis and reliability tests verified the instruments' validity and reliability (Cronbach's $\alpha > 0.80$). Structural equation modeling showed LM had a significant positive effect on SWB ($\beta = 0.40$, $p < 0.001$), while SE partially mediated this relationship (indirect effect $\beta = 0.38$, $p < 0.01$). Significant age differences existed in LM and SE ($F = 14.36$ and $F = 7.75$, $p < 0.01$), with participants aged 60–69 scoring higher than those aged 70+, though no significant SWB difference was found. Education level correlated significantly with LM, SWB, and SE (F values: 6.85–18.33, $p < 0.01$), with higher academic qualifications linked to consistently higher scores. The findings suggest that elderly education institutions should adopt targeted strategies considering age and educational background to enhance LM and thereby promote older adults' SWB.

Contribution/ Originality: This study constructs a Beijing-specific elderly "Learning Motivation-Self-Efficacy-Well-Being" model, incorporating Confucian culture. It validates the mediating role of self-efficacy and offers tiered educational strategies for policymakers. By integrating two theoretical frameworks, this research addresses gaps in the understanding of psychological mechanisms in senior education. It also reveals heterogeneity among the elderly through age and education level analyses, providing empirical support for active aging initiatives.

1. INTRODUCTION

World Health Organization [1] reported that by 2030, people aged 60 or older will make up roughly one-sixth of the world's population [1]. In connection with this, a growing number of countries have begun to focus on gerontological education, typically following the age-friendly university initiative, which leverages the resources of existing universities to encourage lifelong learning, re-employment, and civic participation among older adults [2, 3]. Notably, whereas autonomy and independence in older adults are often emphasized in Western countries, the influence of Confucianism and collective cultural norms has led many older adults in China to integrate traditional values with modern lifestyles and concepts in their daily lives [4-6]. Consequently, under the collision between traditional values and modern culture, the demand for geriatric education in China has gradually diversified, particularly in rapidly developing first-tier cities [7]. More than 20% of Beijing residents are aged 60 years or older, highlighting a serious aging trend in the city [8]. Therefore, the Beijing Municipal Bureau of Statistics National

Bureau of Statistics Beijing Investigation Team [8] proposed developing gerontological education in the city as a means of cultivating lifelong learning in society and enlightening the quality of life (QoL) among older adults [9-11].

Beijing, as the cultural and educational center of China, presents unique sociocultural challenges and opportunities for its elderly population. Confucian culture has a profound impact on the learning motivation, self-efficacy, and subjective well-being of older adults in Beijing. Confucianism advocates lifelong learning and self-cultivation, emphasizing moral improvement and social responsibility through education [12, 13]. Within this cultural context, older adults view learning as a means of self-improvement and fulfilling social responsibilities, which enhances their learning motivation and self-efficacy, ultimately improving their subjective well-being. Research shows that Confucian culture not only strengthens the learning motivation of older adults but also helps them to improve their self-efficacy, enabling them to better cope with the challenges of aging [12]. Moreover, the influence of Confucianism is also reflected in aspects of elderly education related to social participation and health promotion. Korshunov et al. [14] argue that Confucian culture emphasizes social and familial responsibility, which provides a strong motivation for older adults to engage in educational activities, fostering both their psychological and social well-being.

The positive aging theory (PAT), developed by the World Health Organization [15], provides a theoretical basis for the relationship between Subjective Well-Being (SWB) and Learning Motivation (LM) in older adults [15]. This theory suggests that SWB and positive aging exert mutually beneficial effects [16-18]. Additionally, self-determination theory (SDT) suggests that intrinsic motivation in individuals who value self-development is closely related to their SWB [19]. According to SDT, each individual has three basic psychological needs: competence, autonomy, and relatedness, which, when satisfied, increase their motivation to pursue goals, personal growth, and overall well-being [20, 21]. In SDT, the initiative an individual takes to engage in learning due to their value for self-development is referred to as their LM. An individual possessing LM contributes to their development of positive learning attitudes and achieving cognitive development [22-25]. Moreover, research indicates that mechanisms for recognizing learning achievement and awarding certificates for such accomplishments contribute to a person gaining a sense of social recognition, belonging, and attainment [26-28]. Research also indicates that positive learning attitudes can improve older adults' mental health and increase their sense of life gratification and self-actualization [29-32]. Older adults' participation in educational activities can increase their subjective well-being (SWB), and older adults pay more attention to their well-being than to their learning outcomes [9, 33-36]. Older adults tend to engage in learning to enrich their lives and improve their physical and mental health rather than for career development. In a study on the link between SDT and well-being among older adults, Zaini et al. [37] reported that although there is widespread concern for the well-being of older adults, compared with that of younger learners, research on the LM, compared to that of younger learners, is relatively scarce, and the influencing factors have not been fully explored [38-40]. The link between well-being and educational engagement among older adults has increasingly become a topic of interest, and therefore, research into the effects of older adults' LM on their SWB is crucial [41].

Bandura's [42] social cognitive theory (SCT) suggests that self-efficacy (SE) represents confidence in one's own ability to perform well in a given situation [43, 44]. Research indicates that self-efficacy (SE) determines older adults' ability to effectively cope with physiological deterioration and social role transitions; stronger SE is correlated with a greater inclination to view barriers as opportunities for personal growth, engage in learning, and improve one's well-being [45-48]. Research further indicates that SE significantly affects LM and SWB in older adults [49-51]. However, research on the role of SE in SWB among older adults is still limited in terms of the study sample characteristics [52].

The LM of older adults decreases with age [53-55]. SWB also significantly varies with age [56-58]. In addition, research indicates that education level contributes to LM among older adults [55], and SWB increases with education level [58-60]. Sociodemographic characteristics also affect LM among older adults, and there are also differences in

how well-being is defined and pursued. However, cross-contextual research on differences in the learning needs of older adults remains insufficient [58, 61-63], indicating a need for more studies regarding this demographic.

Given the positive impact of LM on SWB in older adults, the present study explored the relationships among LM, SWB, and SE, as well as how these relationships vary by age and educational level.

2. LITERATURE REVIEW

2.1. SE as a Mediator of the Link between LM and SWB

Confucian values, which emphasize self-improvement, family responsibility, and lifelong learning, have fostered a collectivist mindset among older Chinese adults, who often regard learning as a path to self-cultivation and active social participation [64, 65]. Participation in educational activities allows individuals to engage with others, thereby fulfilling their relational needs and enhancing their SWB, particularly for those involved in group-based learning experiences [66-68]. According to SDT, intrinsic motivation and the satisfaction of core psychological needs, such as competence, relatedness, and autonomy, are essential for enhancing SWB [69, 70]. When LM is driven by intrinsic interest, individuals feel a greater sense of autonomy, which enhances their SWB [25, 29, 30, 71]. Research indicates that extrinsic motivation, social interaction, and a sense of belonging increase SWB by improving the quality of social support and interpersonal relationships [72]. The positive effect of the interaction between extrinsic and intrinsic motivation on SWB is particularly evident in older adults engaged in learning [73].

According to goal theory [74], goal setting contributes to LM by increasing confidence in successfully performing learning tasks, and setting clear and challenging goals increases SE [44, 75]. Furthermore, research indicates that SE affects the SWB of older adults [76, 77]. Studies have reported that greater SE improves both individual life satisfaction and the ability to cultivate resilience and withstand stress when facing challenges, which in turn can enhance the QoL of older adults, thereby contributing to their well-being [78-80]. SE thus plays a central mediating role in the link between LM and SWB [50, 81, 82]. Older adults with higher SE typically exhibit greater LM and a sense of accomplishment after completing a task, which further enhances their sense of happiness and well-being [49].

Based on the aforementioned findings, this study proposed the following hypothesis.

H_1: SE mediates the link between LM and SWB in Chinese older adults.

2.2. Differences in LM, SWB, and SE by Age and Education Level

2.2.1. Age-Related Differences in LM, SWB, and SE

Older adults typically have lower LM than younger adults, particularly when it comes to participating in adult education and training [54, 55, 83]. As adults age, their work goals shift from knowledge acquisition to emotional regulation, and many older adults still desire to be rehired after their retirement; therefore, newly retired older adults exhibit higher LM than those who have been retired for a long time [53, 84, 85]. Based on these findings, the current study proposed the following hypothesis.

$H_{2.1a}$: LM differs by age among Chinese older adults.

SWB varies significantly across different age groups. Older adults often experience declines in physical functioning, self-care abilities, and involvement in several social activities, which can lead to increased feelings of helplessness and loneliness, thereby negatively affecting their SWB [56-58, 86, 87]. Conversely, other studies have shown that SWB may actually improve with age, as older individuals often develop the capacity to integrate social relationships and life experiences in a way that fosters a greater sense of meaning and fulfillment in life, ultimately enhancing their well-being [88, 89]. In consideration of these findings, the current study proposed the following hypothesis:

$H_{2.2a}$: SWB differs by age among Chinese older adults.

According to the UN standards, the elderly aged between 60 and 79 are called young-old, and the elderly aged 80 and above are classified as old-old. SE is higher in younger older adults than in their older counterparts. The daily activities of older adults in higher age groups are often limited due to lower physical SE [90-92]. In consideration of this, the current study suggested the following hypothesis:

$H_{2.3a}$: SE differs by age among Chinese older adults.

2.2.2. Education Level-Related Differences in LM, SWB, and SE

The educational level of the students in the courses is higher than that of the general older adult population [93]. Past educational experiences can foster LM, as individuals gain self-confidence after completing educational programs, further enhancing their LM [50, 55, 84]. On the basis of these findings, the current study suggested the following hypothesis:

$H_{2.1b}$: LM differs significantly by education level among Chinese older adults.

Compared to those with low education levels, older adults with high education levels tend to have richer knowledge and stronger cognitive abilities and can better understand and cope with problems in life, and participate in activities to expand their social circles, which improves their SWB [58-60, 90, 94]. In consideration of these findings, this study suggests the following hypothesis:

$H_{2.2b}$: SWB differs significantly by education level among Chinese older adults.

SE varies among older adults according to education level: those with higher education levels may exhibit stronger SE due to their richer knowledge, experience, cognitive abilities, and confidence in problem-solving. They are also more likely to have access to social opportunities [46, 59, 91, 95, 96]. On the basis of these findings, the current study suggests the following hypothesis.

$H_{2.3b}$: SE differs by education level among Chinese older adults.

The relationship between H1 and H2 is shown in Figure 1.

3. METHODS

3.1. Research Framework

Based on the research hypotheses, this study proposed a link between LM, SE, and SWB, as illustrated in Figure 1.

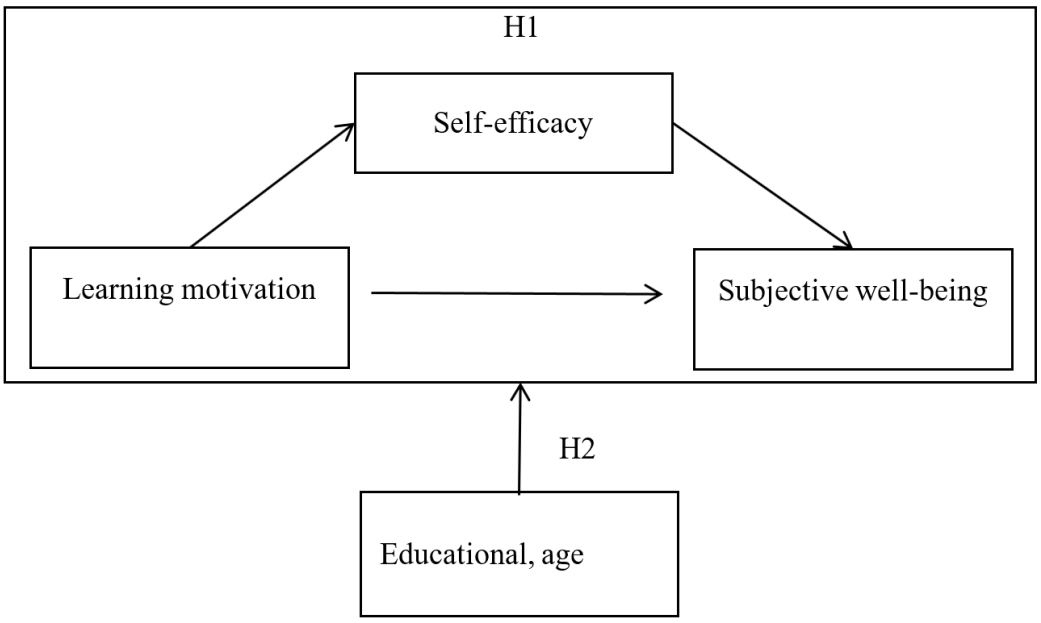

Figure 1. Research framework.

3.2. Participants

Older adults aged 60 and above residing in Beijing, China, were recruited for this study. Upon providing informed consent, participants completed the study questionnaire via Questionnaire Star, a widely used online platform in China. Senior living organizations, community staff, and volunteers assisted participants in accessing and completing the questionnaire by providing guidance and support. Participants could scan a QR code or click a direct link to access the survey. According to the 2023 Report on the Development of Older Adults in Beijing, published by the Beijing Municipal Bureau of Civil Affairs, the number of residents aged 60 or older in the city reached 4.948 million in 2023. Given the challenges associated with random sampling in large populations, purposive (i.e., nonrandom) sampling is often adopted in such contexts [97] and this study followed that approach. Gorsuch [98] recommends that the valid sample size for questionnaire-based studies should be five to ten times the number of research items, with a minimum of 100 respondents [99]. Accordingly, this study distributed 500 questionnaires and received 481 valid responses.

Among the participants who provided valid responses, 222 (46.15%) were men and 259 (53.85%) were women. In terms of age distribution, 262 participants (54.47%) were aged 60-69 years, 141 participants (29.31%) were aged 70-79 years, and 78 participants (16.22%) were aged 80 years or above. Regarding educational attainment, 68 individuals (14.14%) had completed primary school or below, 142 (29.52%) had completed junior high school (JHS), 170 (35.34%) had completed senior high school (SHS) or vocational school, and 101 (20.00%) held a junior college degree or higher (Table 1). The uneven age distribution within the sample may be attributed to a general decline in participation in activities as individuals age and face increasing physical limitations [56-58]. Similarly, the imbalance in educational levels may stem from the questionnaire's screening criteria, which targeted older adults with learning needs, resulting in a relatively lower proportion of participants with minimal formal education [3].

Table 1. Participant demographic characteristics.

Type	Group	Number and rate (N = 481)	
Gender	Male	222	46.15%
	Female	259	53.85%
Age	60-69 years old	262	54.47%
	70-79 years old	141	29.31%
	80years old and above	78	16.22%
Education	Primary school education and below	68	14.14%
	Junior middle school education	142	29.52%
	SHS/technical secondary school education	170	35.34%
	Junior college education and above	101	20.00%

Table 2. Statistical analysis of older adults' learning participation.

	Total	60-69 years old	70-79 years old	80years old and above	Primary school education and below	Junior middle school education	SHS/technical secondary school education	Junior college education and above
Attended university for older adults	62.79%	55.60%	28.80%	15.60%	14.20%	25.50%	34.80%	25.50%
Community learning activities	48.65%	53.40%	28.20%	18.40%	14.10%	32.10%	33.80%	20.10%
Elder care institution learning activities	49.90%	57.10%	26.70%	16.30%	15.40%	31.30%	32.50%	20.80%
Duration < 1 month	24.12%	54.30%	30.20%	15.50%	14.70%	20.70%	37.90%	26.70%
Duration 1 month–2 years	27.23%	49.60%	38.20%	12.20%	7.60%	36.60%	38.20%	17.60%
Duration 2–4 years	31.19%	56.00%	24.70%	19.30%	19.30%	31.30%	27.30%	22.00%
Duration > 4 years	17.46%	59.50%	22.60%	17.90%	14.30%	27.40%	41.70%	16.70%

This study provides a statistical analysis of elderly participation in learning activities over the past five years. Overall, 62.79% of the elderly reported having attended a university for older adults, 48.65% participated in community-organized learning activities, and 49.90% took part in learning activities offered by elder care institutions. In terms of cumulative learning duration, 24.12% of the elderly engaged in learning for less than one month, 27.23% for more than one month but less than two years, 31.19% for more than two years but less than four years, and 17.46% continued learning for over four years. Regarding age distribution, the 60–69 age group showed the highest participation rates, while participation among those aged 80 and above was relatively low. In terms of educational background, individuals with a high school or vocational education had the highest participation rates, followed by those with college or higher education, while those with only middle school or primary education showed relatively lower levels of participation. Overall, the findings indicate that elderly participation in learning activities is strongly influenced by both age and educational attainment (Table 2).

3.3. Research Tools

The research questionnaire employed a 5-point Likert scale format and demonstrated strong reliability and validity. It was composed of three main sections: the Learning Motivation Scale (LM), the Self-Efficacy Scale (SE), and the Subjective Well-Being Scale (SWB). A Likert five-point scale is used, with responses rated as "Strongly Disagree," "Disagree," "Not Sure," "Agree," and "Strongly Agree," corresponding to scores of 1 to 5, respectively.

The LM Scale was adapted from the Education Participation Scale constructed by Boshier and Riddell [100] and consists of 35 items across five dimensions: cognitive interest, social contact, avoidance/stimulation, social service, and external expectations [100]. For the purposes of confirmatory factor analysis (CFA), 21 items from the original scale were retained (Table 3).

Table 3. Measurement items retained in the learning motivation scale (Social contact: Q1 to Q8; escape and stimulation: Q9 to Q13; social service: Q14 to Q18; cognitive interest: Q19 to Q21).

No.	Questionnaire item	Mean	SD	FL
Q1	To maintain or improve my social position	3.22	1.13	0.772
Q2	To share a common interest with my spouse or friend	3.38	1.14	0.723
Q3	To gain insight into human relations	3.30	1.11	0.713
Q4	To improve my social relationships	3.33	1.17	0.796
Q5	To fulfil a need for personal associations and friendships	3.47	1.09	0.825
Q6	To make new friends	3.40	1.08	0.839
Q7	To participate in a group activity	3.38	1.18	0.809
Q8	To meet congenial people	3.41	1.10	0.825
Q9	To relieve boredom	3.57	1.13	0.848
Q10	To take a break from my home or work routine	3.41	1.21	0.759
Q11	To have a few hours away from my responsibilities	3.36	1.19	0.727
Q12	To avoid watching television	3.43	1.14	0.789
Q13	To escape an unhappy relationship	3.35	1.22	0.707
Q14	To gain knowledge that will help me with other educational courses	3.17	1.22	0.769
Q15	To become more effective as a citizen	3.38	1.23	0.695
Q16	To increase my ability to participate in community work	3.25	1.15	0.779
Q17	To prepare for community service	3.17	1.11	0.823
Q18	To increase my ability to serve mankind	3.12	1.16	0.801
Q19	To seek knowledge for its own sake	3.35	0.94	0.934
Q20	To learn for the joy of learning	3.41	0.99	0.900
Q21	To satisfy an enquiring mind	3.38	0.99	0.944

Note: SD: Standard deviation; FL: Factor loading.

The SE Scale was developed based on the General Self-Efficacy Scale (GSES) created by Professor Ralf Schwarzer, a distinguished clinical and health psychologist. It comprises 10 items measuring a single dimension of SE. All 10 items were retained for the CFA (Table 4).

Table 4. Measurement items retained in the self-efficacy scale.

No.	Questionnaire item	Mean	SD	FL
Q22	If I try my best, I can always solve problems.	3.42	1.15	0.790
Q23	Even if others oppose me, I can find a way to get what I want.	3.39	1.22	0.749
Q24	I find it easy to stick to my ideals and achieve my goals.	3.26	1.24	0.790
Q25	I believe I can effectively manage unexpected events.	3.40	1.18	0.774
Q26	With my intelligence, I am confident I can handle unexpected situations.	3.12	1.19	0.760
Q27	If I put in the effort, I can definitely solve most difficult problems.	3.42	1.19	0.787
Q28	I can face difficulties calmly because I believe in my ability to manage problems.	3.38	1.26	0.826
Q29	When faced with difficult problems, I can generally find solutions.	3.46	1.24	0.830
Q30	When experiencing trouble, I can usually think of ways to deal with it.	3.34	1.25	0.822
Q31	I can handle anything that happens with ease.	3.21	1.29	0.786

Note: SD: Standard deviation; FL: Factor loading.

The SWB Scale utilized in this research was adapted from the abbreviated version of the Subjective Well-Being Scale for Urban Residents in China, developed by Wang and Xing [101]. Following a screening of the original entries, 20 items covering 3 dimensions: health, satisfaction, and development experience were initially selected. Among these, the following items were identified as reverse-worded: JK1, JK2, JK3, JK4, JK5, JK6, JK8, MZ2, MZ3, MZ4, and FZ4. These reverse items were recoded into positive scores to ensure scoring consistency throughout the scale. Ultimately, 14 items were retained for the CFA (Table 5).

Table 5. Measurement items retained in subjective well-being scale (Satisfaction: Q32 to Q37; Relationship: Q38 to Q41; Development: Q42 to Q45).

No.	Questionnaire item	Mean	SD	FL
Q32	I am often troubled by trivial matters.	3.61	1.14	0.760
Q33	When I come across something unpleasant, my mood remains low for a long time.	3.50	1.18	0.731
Q34	Compared with the people around me, I am quite content.	3.47	1.16	0.761
Q35	Compared with the people around me, I feel that I have suffered a loss.	3.53	1.17	0.766
Q36	I often feel that I am going through life aimlessly.	3.56	1.19	0.765
Q37	I have worse luck than others do.	3.41	1.19	0.768
Q38	I feel that most people have more friends than I do.	3.51	1.10	0.716
Q39	I often find building friendships with others difficult.	3.47	1.17	0.804
Q40	I feel especially happy when I am with my family.	3.58	1.13	0.790
Q41	I sometimes find communication with my family members (such as parents, spouse, and children) to be difficult.	3.51	1.13	0.810
Q42	Society will provide more and more ways out for people.	3.30	1.18	0.567
Q43	As I grow older, I have learned a lot of truths from life, which have made me stronger and more capable.	3.44	1.08	0.788
Q44	I am glad that my views have become increasingly mature over time.	3.44	1.09	0.863
Q45	Most of the life goals I set inspire me rather than discourage me.	3.45	1.17	0.776

Note: SD: Standard deviation; FL: Factor loading.

3.4. Research Procedure

This study was administered by community workers, volunteers, and staff from elderly care institutions, with assistance from the elderly participants' family members. The questionnaire was created on the Chinese online platform Wenjuanxing and distributed via methods such as WeChat QR codes to collect data. If participants had difficulty reading the questions or operating the survey, the administrators or family members assisted by reading the questions aloud or helping to select responses based on the participants' verbal answers.

The study distributed questionnaires to 500 elderly individuals. After completing the questionnaires, 19 invalid responses were excluded, resulting in 481 valid questionnaires being collected, with a response rate of 96.2%. To confirm the consistency and reliability of the questionnaire, internal consistency analysis was conducted using SPSS 24 software. Additionally, Confirmatory Factor Analysis (CFA) was performed using AMOS 26 software to test the validity of the formal questionnaire and verify its reliability and validity.

3.5. Data Analysis

Firstly, the reliability of our research instrument was assessed and confirmed through a comprehensive validation process. A CFA measurement model was developed to evaluate the core constructs of LM, SE, and SWB. After reverse-coded items were recoded appropriately, 11 items from the LM Scale and 6 items from the SWB Scale were removed due to insufficient factor loadings, as shown in Tables 2-4. To determine the reliability of the questionnaire, four key metrics were used. Composite reliability values for the eight latent dimensions, namely, social contact, avoidance or stimulation, social service, cognitive interest, SE, gratification experience, relationship experience, and developmental experience, were 0.93, 0.88, 0.87, 0.94, 0.93, 0.91, 0.86, and 0.85, respectively, all of which exceeded the acceptable threshold of 0.70 [102]. Likewise, the average variance extracted (AVE) values for these eight constructs were 0.63, 0.59, 0.58, 0.84, 0.59, 0.63, 0.61, and 0.58, respectively, indicating adequate convergent validity as they all surpassed the suggested minimum of 0.50 [102]. Moreover, the confidence intervals of the correlation parameters, estimated using the bootstrap method, did not include the value of 1, confirming discriminant validity [103]. Additionally, a one-factor model comprising 45 valid items was constructed to evaluate the potential presence of common method bias, and the model fit was found to be acceptable ($\chi^2 = 2175.03$, $p < 0.001$, $\chi^2/df = 2.37$, GFI = 0.84, CFI = 0.92, RMSEA = 0.053) [102]. Based on the evidence from composite reliability, AVE, correlation confidence interval estimation, and single-factor testing for common method variance, the eight latent constructs demonstrated robust construct validity and showed no signs of spurious relationships [104].

The 45 valid items in the CFA measurement model had reasonable factor loadings (all > 0.50) [105]. Additionally, the data from the 481 participants were normally distributed, exhibiting both univariate ($-0.54 \leq$ slope value ≤ 0.02; $-.1.14 \leq$ kurtosis value ≤ -0.34; Hair et al. [102] and multivariate normality (Mardia's value = 48.83 [106]. Besides, the Cronbach's alpha coefficients for LM, SE, and SWB were 0.94, 0.93, and 0.93, respectively. Moreover, the CFA model followed the criteria for the preliminary model fit indices, which included significant error variance with no negative values, correlation coefficients between 0.31 and 0.66, and factor loadings between 0.56 and 0.95 [102]. The model fit results are shown in Table 6, indicating that the model fits the scale well. Additionally, the CFA measurement model results reflected the measurement validity of the three scales. The mediating effect of SE on the link between LM and SWB was confirmed through the structural equation model's pull-out method. SPSS and ANOVA were used to analyze variances in LM, SWB, and SE among older adults of various ages and education levels.

Table 6. Scale fit indices.

Scale	$\chi 2/df < 5$	RMR < 0.08	AGFI ≧0.8	RMSEA < 0.08	NFI > 0.9	TLI> 0.9	CFI> 0.9	RFI> 0.9	IFI> 0.9	PNFI> 0.5	PCFI> 0.5
LM	3.11	0.06	0.87	0.07	0.92	0.94	0.94	0.91	0.94	0.80	0.82
SE	1.90	0.03	0.96	0.04	0.98	0.99	0.99	0.97	0.99	0.76	0.77
SWB	2.45	0.05	0.93	0.06	0.96	0.97	0.97	0.95	0.97	0.78	0.79

4. RESULTS

4.1. Total Mediating Effect

The H1 model was constructed with AMOS software, used to assess the total mediating effect. Model fit, path coefficients, factor loadings, and variances were assessed to determine the plausibility of the H1 model. After confirming the significance of the three paths in the H1 model, the total, direct, and indirect model effects were assessed through the self-help method of estimation to determine whether the mediation was full or partial [107, 108]. The overall mediation model demonstrated an acceptable fit ($\chi^2 = 270.866$, $p < 0.001$, $\chi^2/df = 2.335$, adjusted goodness-of-fit index = 0.918, CFI = 0.968, RMSEA = 0.053), with factor loadings ranging from 0.567 to 0.944, suggesting strong construct representation. As illustrated in Figure 2, LM significantly predicted SE ($\gamma = 0.77$, $R^2 =$ 68%, $p < 0.001$), and both SE ($\gamma = 0.42$, $p < 0.001$) and LM ($\gamma = 0.40$, $p < 0.001$) were significant predictors of SWB, with a combined explanatory power of 59% ($R^2 = 59\%$). To further validate the mediating mechanism, the indirect,

direct, and total effects of LM on SWB were estimated using a 95% confidence interval via bootstrapping (Table 7). The results indicated a significant indirect effect of LM on SWB through SE (θ= 0.327, p < .001), along with a significant direct effect (θ= 0.395, p < 0.001), yielding a total effect of (θ= 0.722 (p < 0.010), thereby confirming that the mediating role of SE was partial rather than full, and providing empirical support for hypothesis H1.

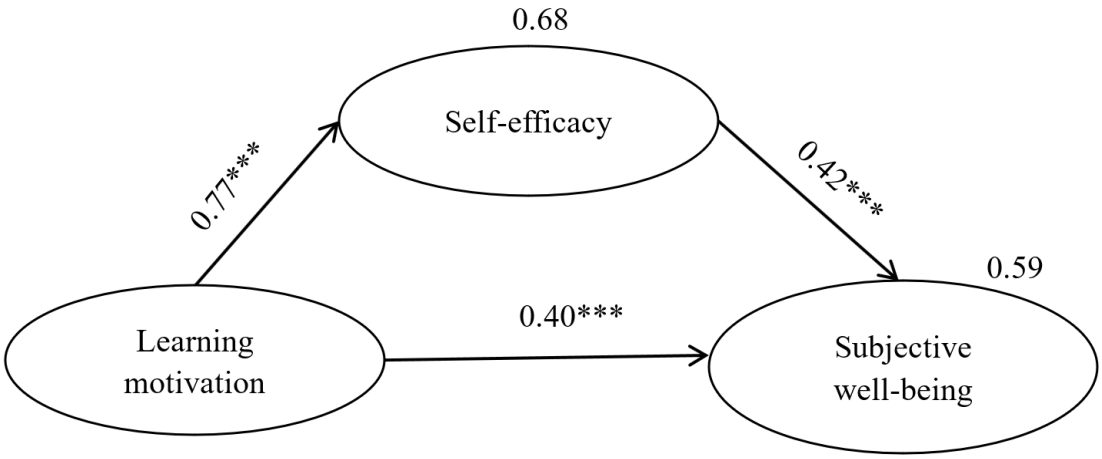

Figure 2. Total mediating model.

Note: *** p < 0.001.

Table 7. Bootstrap estimates of general self-efficacy as a mediator between learning motivation and subjective well-being.

Mediating effect	Value	Bias-corrected percentile method 95% confidence interval	
		Lower bound	Upper bound
Total effect	0.72***	0.65	0.80
Direct effect	0.40***	0.20	0.46
Indirect effect	0.38***	0.22	0.58

Note: ***p < 0.001.

4.2. Differential Analysis

Differential analysis, a hypothesis testing approach, was utilized in this research to evaluate whether specific factors account for variations in the data, with a particular focus on differences in LM, general SE, and SWB among older adults categorized by age and education level. A one-way ANOVA was conducted to assess group-level differences across these variables.

When the ANOVA results revealed statistically significant differences, the selection of an appropriate post hoc testing method depended on the outcome of the homogeneity of variance test; specifically, whether the assumption of equal variances was met or violated. Based on this, suitable post hoc comparisons were then performed to identify which groups differed significantly.

Additionally, the effect size was measured using η^2 (eta-squared), which quantifies the proportion of variance in the dependent variable attributable to the independent variable. According to the benchmarks established by Cohen [109] η^2 values between 0.010 and 0.059 represent a small effect size, values between 0.059 and 0.138 indicate a medium effect size, and values of 0.138 or higher reflect a large effect size, thereby providing insights into the practical significance and explanatory power of the observed group differences.

4.3. Age-Based Differences in Variables

A one-way ANOVA was performed to scrutinize differences in LM, SWB, general SE, and social adjustment among older adults across different age groups, with the findings summarized in Table 8.

Table 8. ANOVA of variable differences by age.

Dimension & overall	Mean (SD)			F	post-hoc comparisons
	60-69 (n=262)	70-79 (n=141)	80 and above (n=78)		
Social contact	3.49(0.89)	3.37(0.96)	2.94(0.83)	12.69***	1、2>3
Avoidance or stimulation	3.59(0.95)	3.30(0.98)	3.10(0.87)	10.27***	1>2、3
Social service	3.34(0.92)	3.16(0.99)	2.91(0.93)	6.79**	1>3
Cognitive interest	3.45(0.94)	3.40(0.89)	3.08(0.84)	5.72**	1、2>3
Learning motivation	3.47(0.73)	3.31(0.76)	2.99(0.69)	14.36***	1>2>3
Satisfaction experience	3.57(1.01)	3.44(0.89)	3.45(0.99)	1.08	,
Relationship experience	3.61(0.90)	3.38(1.02)	3.47(0.84)	2.70	,
Development experience	3.48(0.95)	3.31(0.93)	3.35(0.88)	1.65	,
Subjective well-being	3.56(0.84)	3.39(0.84)	3.43(0.78)	2.11	,
Self-efficacy	3.47(0.94)	3.32(0.95)	2.97(1.01)	7.75**	1、2>3

Note: **p < 0.01, ***p < 0.001.

Significant age-related differences were observed in overall LM and its four dimensions: social contact, avoidance or stimulation, social service, and cognitive interest, with F-values of 14.36, 12.69, 10.27, 6.79, and 5.72, respectively. Post hoc comparisons indicated a decline in overall LM across age groups, specifically from ages 60-69 to 70-79, and again from 70-79 to 80 years or older.

The dimensions of social contact and cognitive interest were significantly higher among participants aged 60-69 and 70-79 compared to those aged 80 and above, although no statistically significant differences were noted between the 60-69 and 70-79 age groups for these two dimensions. In terms of social service, older adults aged 60-69 reported significantly higher levels than those aged 80 or older, while no significant differences were observed between the 60-69 and 70-79 groups or between the 70-79 and 80+ groups, suggesting that certain aspects of LM may remain stable until more advanced age, after which they tend to decline.

No significant differences were found in overall SWB or its three dimensions, satisfaction, relationship experience, and developmental experience, among older adults across different age groups, as indicated by the corresponding F-values of 2.11, 1.08, 2.70, and 1.65, respectively, suggesting that SWB remains relatively stable regardless of age in later adulthood.

General SE showed significant variation among older adults in different age groups, with an F-value of 7.75 reaching the 0.01 significance level, indicating meaningful age-related differences. Post hoc comparisons revealed that older adults aged 60-69 and 70-79 exhibited significantly higher levels of general SE compared to those aged 80 and above, while no statistically significant variance was noted between the 60-69 and 70-79 age groups, suggesting a decline in SE primarily occurs in the oldest age bracket.

4.4. Education Level-Based Differences Between Variables

A one-way ANOVA was conducted to examine differences in LM, SWB, general SE, and social adjustment among older adults with varying levels of education, with the results detailed in Table 9. This analysis aimed to identify whether educational attainment significantly influenced these psychological and social constructs in later life, providing insight into how education may contribute to motivational, emotional, and adaptive outcomes among aging individuals.

Table 9. ANOVA of variable differences by education level.

Dimension & overall	Mean (SD)				F	Post-hoc comparisons
	Elementary school and below (n=68)	JHS (n=142)	SHS/Secondary school (n=170)	Junior college and above(n=101)		
Social contact	3.08(0.87)	3.22(0.93)	3.37(0.96)	3.76(0.73)	10.09***	4、3>2、1
Avoidance or stimulation	3.13(0.99)	3.28(1.02)	3.43(0.96)	3.82(0.73)	9.19***	4、3>2、1
Social service	2.90(0.84)	2.92(0.93)	3.35(0.93)	3.62(0.89)	15.89***	4、3>2、1，4>3
Cognitive interest	3.09(0.92)	3.20(0.86)	3.35(0.93)	3.87(0.81)	16.17***	4、3>2、1
Learning motivation	3.05(0.66)	3.16(0.72)	3.38(0.79)	3.76(0.59)	18.33***	4、3>2、1，4>3
Satisfaction experience	3.86(0.81)	3.27(1.05)	3.52(0.98)	3.62(0.86)	6.54***	1>3、2，4、3>2
Relationship experience	3.52(0.97)	3.27(1.03)	3.55(0.89)	3.82(0.83)	6.86***	4>3、1、2，3>2
Development experience	3.25(0.89)	3.19(1.04)	3.48(0.89)	3.70(0.80)	7.15***	4>1、2，3>2
Subjective well-being	3.59(0.76)	3.25(0.92)	3.52(0.81)	3.70(0.71)	6.85***	4>2，1>3>2
Self-efficacy	3.08(0.98)	3.07(0.97)	3.42(0.97)	3.78(0.78)	13.78***	4>3>1、2

Note: ***$p < 0.001$.

Significant differences were found in overall LM and its four dimensions, social contact, avoidance or stimulation, social service, and cognitive interest, among older adults with varying levels of education, as reflected in F-values of 18.33, 10.09, 9.19, 15.89, and 16.17, respectively. Post hoc comparisons revealed that older adults with a senior high school (SHS) or secondary school education, as well as those with a junior college degree or higher, reported significantly higher levels of overall LM and social service than those with only a junior high school (JHS) or primary school education or below. Furthermore, individuals with a JHS or primary education exhibited significantly lower levels of LM and its four subdimensions compared to more highly educated participants. Notably, respondents with a junior college education or above demonstrated significantly greater overall LM and social service engagement than those with either SHS or JHS educational backgrounds, underscoring the positive influence of higher educational attainment on lifelong LM in older adulthood.

SWB and its three dimensions, satisfaction, relationship experience, and development experience, varied significantly among older adults with diverse education levels, with F-values of 6.85, 6.54, 6.86, and 7.15, respectively, all reaching the .001 significance level, indicating strong educational effects on well-being outcomes. Post hoc comparisons revealed that older adults with a junior college education or above reported significantly higher overall SWB compared to those with a JHS education. Interestingly, participants with a primary school education or below reported greater overall SWB than those with a high school or vocational education, who in turn reported greater well-being than respondents with a JHS education. In terms of satisfaction experience, older adults with a primary school education or below scored higher than all other education groups, while those with a SHS or junior college education level or above reported significantly greater satisfaction than those with only a JHS education. For the relationship experience dimension, respondents with a junior college education or above had the highest scores. Regarding development experience, older adults with a junior college education or higher scored significantly better than those with a JHS or primary school education, and individuals with high school or vocational school education scored higher than those with only a JHS education, collectively suggesting that higher educational attainment is generally associated with more favorable SWB outcomes in later life.

General SE showed significant variation among older adults with diverse education levels, as indicated by an F-value of 13.78 at the 0.001 significance level. Post hoc comparisons revealed that older adults with a junior college education or above exhibited significantly higher levels of general SE than those with a high school or vocational school education, who, in turn, reported significantly higher SE than participants with a JHS or primary school education level or below, highlighting a clear positive association between educational attainment and SE in later life.

5. DISCUSSION AND CONCLUSION

5.1. Discussion

This study offers valuable insights into the relationship between LM, SWB, and SE in older adults, as well as the factors influencing these variables. A mediation model was developed to explore the factors influencing older adults' SWB. The empirical results suggest that LM increases SWB among older adults.

5.2. Mediating Effect of SE on LM and SWB

In this study, SE partially mediated the association between LM and SWB, supporting H1. Detailed statistical results are presented in Table 7. This finding aligns with the work of Deci and Ryan [21] regarding SDT and SCT. SE plays a central role in geriatric education and mediates the link between LM and SWB [49, 50, 81]. The results of the present study also indicate that LM can directly and positively predict SWB. LM fosters the pursuit of goals, growth, and well-being [20, 21]. Additionally, the results reveal that LM indirectly predicts SWB through SE, consistent with other studies highlighting the key role of LM in geriatric education [78, 80, 110]. Individuals experience greater autonomy when LM stems from their intrinsic interest, and education is self-selected, and this autonomy is related to higher SWB [29, 30]. The results of this study extend the literature by emphasizing the partial mediating effect of SE in the link between LM and SWB.

5.3. Differences in LM, SE, and SWB by Age and Education Level

This study found that LM and SE significantly declined with age, while no age-related differences were observed in SWB. The detailed statistical results can be found in Table 8. These findings partially support H2. The findings regarding age-based differences in LM and SE are consistent with those of other studies. These findings partially support H2. The findings regarding age-based differences in LM and SE are consistent with those reported by Lin [54]; Yamashita et al. [55]; Chang and Lin [83]; Martinez-Lopez et al. [90]; Wang et al. [91] and Xin et al. [92]. Gegenfurtner and Vauras [53] attributed learning in older adults to emotion regulation and interest, which can reduce the motivation to learn new skills. Cybulski et al. [45] found that the physical decline, greater health problems, social role changes, and shrinking social circles associated with age may reduce SE in older adults [45]. However, other studies have presented alternative findings on SWB. Yanardağ et al. [58] reported that older adults experience increasing loneliness and helplessness as they age because of limitations that reduce their participation in social and physical activities, which in turn affects SWB [58], whereas [89] demonstrated that SWB increases with age because older adults perceive themselves to have a stronger understanding of the meaning of life. In the present study, no relationship was observed between age and SWB [89].

In this study, LM, SWB, and SE differed significantly by education level. The detailed statistical results can be found in Table 9. Except for the satisfaction experience dimension of SWB, where participants with a primary school education or below reported the highest scores, all other overall and dimensional measures were highest among those with a junior college education or higher. These findings are consistent with those of previous studies, Hu [50]; Zhao et al. [93]; Wang et al. [94] and Chen et al. [95]. Lai et al. [60] reported that older adults with a higher education level have a stronger understanding of various matters, more experience, and a wider knowledge base, which fosters self-confidence and SE when they participate in learning activities, which in turn improves their LM [60]. SWB may improve during the learning process when individuals engage in active problem-solving and social activities [58, 59,

90]. Regarding the satisfaction experience dimension of SWB, An et al. demonstrated that health status and social relationships have a pronounced effect on satisfaction in older adults, indicating they could partially negate the positive effect of education level on life satisfaction [111].

In summary, LM positively affects SWB through SE in older adults. Additionally, LM and SE differ according to age, and LM, SE, and SWB differ by education level. This study contributes to the empirical analysis of the mechanism by which Learning Motivation (LM) influences Subjective Well-Being (SWB) in older adults via Self-Efficacy (SE), thereby expanding research in both lifelong learning theory and gerontology. The findings suggest that older adults with higher education levels enhance their learning motivation through stronger self-efficacy, which in turn indirectly improves their subjective well-being. This result is consistent with Self-Determination Theory in the context of lifelong learning. Additionally, the study reveals a negative effect of age on learning motivation and self-efficacy, although no significant relationship was found between age and subjective well-being. This underscores the importance of education level and lifelong learning, suggesting a potential pathway to improving older adults' well-being through the enhancement of their learning motivation and self-efficacy. The study offers significant theoretical support and practical guidance for future research and interventions in the fields of elderly education, social support, and well-being.

5.4. Conclusion

The mediation model proposed in this study was validated and aligned with the foundational principles of PAT, SDT, goal theory, and SCT [18, 69, 70, 74, 80]. The study drew several key conclusions from data collected from Chinese older adults: (a) LM significantly positively affected SWB; (b) SE partially mediated the relationship between LM and SWB; (c) both LM and SE declined with age; and (d) LM, SE, and SWB varied significantly by education level. Notably, with the exception of the satisfaction experience dimension of SWB, participants with a junior college education level or higher consistently reported the highest levels of LM, SE, and SWB. These findings highlight LM as a key contributor to the well-being of older adults and emphasize the role of SE in enhancing psychological outcomes in later life. Consequently, geriatric education programs should be designed with sensitivity to age- and education-related differences to promote learning engagement, psychological empowerment, and overall well-being in aging populations more effectively.

These findings provide empirical support for SDT and extend its applicability to the education of older adults. This study considered the influence of age and education level in educational programs, allowing existing theories to be applied to individuals from previously unexplored demographic groups. It also effectively identified differences in learning among older adults with various demographic backgrounds.

5.5. Recommendations

A mediation model was constructed on the basis of SDT and PAT [16, 19, 20, 37, 63] to examine the effect of SE on the link between LM and SWB, model quality was assessed using structural equation modeling, which indicated a satisfactory fit and 59% overall explanatory power. The age and educational level of older adults influenced the variables in the model. Based on these findings, the following recommendations are proposed to improve well-being among older adults.

Strengthening LM: Communities, institutions, and universities for older adults can organize learning activities to stimulate their interest and motivation in learning. Experience-sharing regarding successful QoL improvements and the development of friendships through skill learning can promote the positive effects of learning and ensure that activity content is relevant to the actual needs of older adults [112]. Additionally, older adults should be encouraged to recognize the value of learning and actively engage in it.

Increasing SE: Learning goals should be set according to the abilities and experiences of older adults. Making gradual progress toward these goals can increase older adults' sense of SE. Peer-help learning groups can be arranged

to assist older adults in developing problem-focused coping methods and building their self-confidence through mutual exchanges, which can improve their SE and subjective sense of well-being [86].

Centering the needs of older adults: In response to decreased LM and SE due to aging, simple and accessible learning activities, such as handicraft or health care lectures, can be offered to older adults. These activities are less challenging and, therefore, less intimidating. Unlike academic courses, they are less likely to reduce LM. Consequently, they can increase older adults' SE and SWB.

5.6. Limitations and Future Research

This study employed a cross-sectional design, with a sample of older adults residing in Beijing, which limits external validity and restricts causal inferences. Therefore, the findings may not be widely applicable to other regions or older adult populations with distinct demographic characteristics. Future research should include a more diverse sample of Chinese older adults from various settings such as nursing institutions, universities for seniors, and broader community groups, incorporating individuals with varying physical conditions to enhance the robustness of the conclusions drawn. Additionally, the current study did not compare the sample with older adults of differing demographic characteristics. To strengthen the validity of the proposed mediation model, future studies should examine variations in LM across subgroups of older adults with distinct characteristics and conduct comparative analyses among demographically homogeneous groups.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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