臺灣運動教育學報
民國 113，19(2)，1-24
https://doi.org/10.6580/JTSP.202411_19(2).0001

Exploring the role of physical literacy in the physical education of older adults in the post-COVID pandemic

Kuei-Shu Huang*
Office of Physical Education,
Tamkang University
I-Cheng Chen
Office of Physical Education,
Tamkang University

Abstract

The outbreak of COVID-19 has had a significant impact on various aspects of daily life, including physical activities (PAs) and health, leading to the introduction of online teaching and learning at all levels and fields, including sport and physical education (PE). Therefore, this research identified the pathways between the physical literacy (PL), self-efficacy (SE), intrinsic motivation (IM), and course satisfaction (SAT) of older adults in online sports course learning contexts. This research utilized convenience sampling methods to collect data from 60 surveys distributed to older adults participating in senior online sports courses at a university in Taiwan in 2021. Descriptive statistics, Pearson's correlation test, and hierarchical regression were used to analyze the data. The results indicated that PL is positively associated with IM, SE, and SAT. Furthermore, IM in sporting contexts is a potential mediator between PL and SAT. However, SE is not have significantly associated with the mediation between PL and IM. The findings of this research suggested that PL is directly related to SE and IM, and it's also associated with higher SAT through the state of IM in older adults. Therefore, it is essential to strengthen the PL of older adults and promote their continuous participation in PA behaviors actively, as this is an important indicator of healthy aging.

Keywords: self-efficacy, intrinsic motivation, distance learning, mediation effect, chronic diseases

1. Introduction

The aging population is increasing globally, and the COVID-19 pandemic has affected the physical activity (PA) levels of various communities, including older adults (Yamada et al., 2020). The social isolation and restrictions caused by the pandemic have led many older adults to reduce their daily activities, which not only affects their physical health. However, Regular exercise can reduce chronic diseases and prevent disability in older adults. However, exercise prescription and management for seniors need to be professionally designed to meet their unique needs (Boldovskaia et al., 2023; Cornish et al., 2020). In particular, the mental health status of seniors, also known as older adults or elderly individuals, can vary significantly due to various factors such as their overall health, social support, life circumstances, and personal resilience. While many seniors enjoy good mental health and well-being, it is important to acknowledge that a minority may face mental health challenges. These challenges include issues related to emotional responses and various cognitive functions. Through fitness exercises, not only can the physical fitness of the seniors be enhanced, but it can also delay cognitive decline and reduce psychological issues such as depression through social interactions. Furthermore, by promoting education and well-being awareness, the recognition of mental health issues among older adults and their caregivers can be improved, helping to reduce social stigma and ensure appropriate support is provided. Therefore, each older adult is unique, and their mental health needs may differ and require attention and fulfillment.

Physical literacy (PL) is a measure of increased lifelong participation and the ultimate indicator for maximizing the benefits of participation in sports (Wang et al., 2020; Whitehead, 2019). Physical literacy originated from the philosophical argument on monism, existentialism, and phenomenology within the physical education context and further expanded to the public health context during a nearly two-decade development (Wang et al., 2020; Whitehead, 2019). Conducting the physical literacy research on young adults, adults, and the aging population across different environments should be initiated, after concluding the excessive research studies on children and adolescents in a systematic review. The individuals' physical activity habits then become independent behavior and vary depending on their demographic backgrounds such as age, marital status, education level, occupation, living conditions,

family income, etc. Nonetheless, in the concept of physical literacy, motivation is one of the dispositions “to capitalize on innate movement potential to make a significant contribution to the quality of life” (Whitehead, 2019, p. 12). When the individuals demonstrate motivation on making unique physical literacy journey progress, it is about the interest, enthusiasm, and perseverance in solving physical activity tasks in a challenging environment.

The World Health Organization (WHO) predicts that the global population aged 60 years or older will exceed 2 billion by 2050. The Coronavirus disease 2019 (COVID-19) pandemic has further restricted the physical activities of older adults, making them more susceptible to chronic diseases (WHO, 2020). Therefore, promoting regular exercise among older adults is crucial for reducing the risk of chronic diseases and improving their quality of life. Despite its importance in global health and exercise education, PL has rarely been explored in the context of older adults. The COVID-19 pandemic has led to the introduction of online teaching and learning in the field of physical education (PE; Chodzko-Zajko et al., 2009; Jones & Rikli, 2002) and sports, yet the feasibility and effectiveness of online learning for senior citizens have rarely been explored (Górnicka et al., 2020). Górnicka et al. (2020) discussed the impact of the COVID-19 pandemic on daily human habits, including changes in dietary habits and lifestyle. Although Górnicka et al. focused on the dietary habits and lifestyle of Polish adults, their findings highlight how people adapted to new ways of living during the pandemic. This has certain similarities to our study, which explores how older adults adapt to online learning environments. There have also been positive and negative predictions of the relationship between physical fitness and IM in motor learning contexts, and there are still possible unexplained mechanisms (Koolhaas et al., 2018). Yamada et al. (2020) highlighted the impact of the COVID-19 pandemic on the physical activity of older adults in Japanese communities, providing data on changes in physical activity during the pandemic. Sum et al. (2022) provided insights into the implementation barriers and facilitators of health assessments for older adults in community settings. Wang et al. (2020) explored the importance of physical literacy across different age groups and emphasized that physical literacy enhances self-efficacy (SE) and intrinsic motivation (IM), promoting continuous participation in physical activities. Moore and Fry (2017) found that intrinsic motivation mediates the

relationship between physical literacy and course satisfaction (SAT), indicating that improving physical literacy in older adults can increase their satisfaction with exercise courses by enhancing their intrinsic motivation. In summary, there is a need to examine the pathways between PL, SE, IM, and SAT in an online exercise course learning context for seniors, based on a PL perspective, to understand how these pathways affects the mental health status of seniors.

The study aims to fill the gaps in the current research by examining the pathways between PL, SE, IM, and SAT in an online exercise course learning context for seniors. The findings of this study will contribute to the development of effective exercise programs for seniors, especially in the context of the COVID-19 pandemic. The study will also shed light on the impact of PL on the mental health status of seniors and provide insights into the antecedents of motor learning contexts for older adults.

2. Literature Review

2.1 Physical Literacy (PL)

Physical literacy (PL) is the motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for engagement in PAs for life (Whitehead, 2019). PL also refers to the integration of physical, perceptual, knowledge, cognitive, psychological, social, and behavioral capabilities, echoing the need for an active, healthy, and fulfilling lifestyle (Wang et al., 2020; Whitehead, 2019). Campelo and Katz (2020) indicated that new technologies, such as exergames and wearable fitness trackers, could help older adults improve their PL and stimulate their participation and ongoing engagement in PA. Participants expressed positive views on using technology for exercise, despite concerns about unfamiliarity with technology and cost issues. These technologies not only helped enhance older adults' self-efficacy and physical function but also promoted their social interaction and exercise behavior, thereby supporting their health needs. The study emphasized that integrating technology into exercise programs may improve older adults' PL levels and reduce age-related risks of injuries and chronic diseases. Petrusevski et al. (2021) also mentioned that physical literacy (PL) was crucial for improving functional health in adults, particularly for older adults. Their study found that engaging in purposeful, social, and diverse activities, acquiring knowledge of age-related changes, and being able to self-

adapt to mobility fluctuations were fundamental to becoming physically literate older adults. These activities and knowledge helped enhance older adults' self-efficacy, physical function, and exercise behavior, thereby supporting their rehabilitation needs. By reconceptualizing the construct of physical literacy to include the functional health needs of older adults, this study added value to the fields of public health and policy, emphasizing the importance of physical literacy in promoting health among older adults. PL could protect older adults from chronic diseases and disabilities. Individuals who are physically literate are more likely to engage in lifelong exercise or PA, since they believe and value the contribution that PA has for their health. Across a life span, PL is more critical to older adults than to people of other ages.

2.2 Self-efficacy (SE)

Self-efficacy (SE) is based on the tenets of social cognitive theory, which favors the concept of interaction where behavior, personal factors, and environmental influences all operate interactively as determinants of each other (Bandura, 2001). SE is an important motivational construct that influences individual choices, goals, emotional reactions, effort, coping, and persistence. It refers to individuals' convictions about their abilities, and consequently, an important set of cognitions is SE or beliefs about one's capacity to perform at designated levels (Whitehead, 2019). The application of the SE construct to PE has been proposed to predict the likelihood of an individual being able to self-assess their physical fitness status (Guay et al., 2000). Specifically, SE refers to the strength of a person's belief that they are capable of successfully performing the various roles and tasks of the sports learning experience.

2.3 Intrinsic motivation (IM)

Motivation is defined as the "activating orientation of current life pursuits toward a positively evaluated goal state" (Rheinberg & Vollmeyer, 2018, p. 15). Thus, the performance of an activity may possess positive or negative incentives. When incentives are positive, individuals may engage in an activity purely for enjoyment. Intrinsic motivation (IM) is also defined as the doing of an activity for its inherent satisfaction, rather than for some separable consequence. When intrinsically motivated, a person is moved to act for the fun or challenge entailed, rather than because of external products, pressures, or rewards (Ryan & Deci, 2000). Moreover, IM refers to doing an activity simply for the enjoyment of the activity itself, rather than its instrumental value.

Self-efficacy (SE) and intrinsic motivation (IM) play crutial roles in older adults' participation in fitness exercise programs. SE significantly influences the enthusiasm and persistence of older adults in engaging with exercise routines. High SE enhances their likelihood of active participation and sustained involvement, thereby improving physical fitness and overall health outcomes. Concurrently, older adults with high IM are more likely to continue exercising due to the enjoyment and fulfillment derived from the activity itself.

3. Hypothesis Development

3.1 The relationship between exercise situational PL, SE, and IM.

Many studies have demonstrated the positive benefits of moderate exercise on physiological, psychological, quality of life, and social-interpersonal interactions (Reed & Ones, 2006). Previous research has suggested that PL and SE can be enhanced through the implementation of teaching methods and content in a movement-learning context (Pot et al., 2018; Wang et al., 2020). In their theories of motivation, Deci and Ryan (1991) emphasized that a person's motivation consists of IM, extrinsic motivation, and no motivation, which vary from high to low with the degree of self-determination, starting with IM as the highest and no motivation as the lowest. These changes in the degree of self-determination will affect the individual's behavior in participating in the activity. Based on the above, we suggest that participation in exercise learning will affect exercise behavior and PA practice due to the individual's IM status and will demonstrate the effectiveness of individual exercise through actual exercise participation behavior (Robinson et al., 2018). Consistent with the literature reviewed above, we have formulated the following specific hypotheses (the model of hypotheses, please refer to Figure 1) :

H1*: PL, SE, and IM are related.*

3.2 Individual PL in sporting contexts affects course SAT through the mediation of IM.

Previous studies have confirmed that an individual's IM plays an important role in their participation in the motor learning experience, such as subjective well-being (Ntoumanis, 2001), SAT (Moore & Fry, 2017), learning effectiveness (Perlman, 2013), emotional response (Nicholls, 1984), cognitive style (Ames & Arch, 1988), and

cognitive performance (Ntoumanis, 2001; Ames & Arch, 1988), and in other pathways that ultimately influence individual exercise performance. The current global outbreak of the coronavirus (COVID-19) has not only affected the PA routine of various ethnic groups, but also caused significant health effects (Górnicka et al., 2020). In the case of college PE programs, for example, changes in online instruction due to COVID-19 may affect the amount of time that students spend on participating in PE, the amount of space needed for PE, and the performance of motor behaviors (i.e., completion of general motor skills). However, physical literacy (PL) has been proven to be an important indicator of student learning outcomes in physical education classes. Nevertheless, whether an individual's intrinsic motivation is related to student PL and participation in online courses requires further research to verify.

In addition, satisfaction is a comprehensive and complex concept defined as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns(Wang et al., 2020).It concerns a wide range of individuals' aspects of physical health, psychological, independence, social relationships, environment, and beliefs. These non-cognitive outcomes can be perceived not only as prerequisites of learning but may also be regarded as goals of education. Moreover, a positive and reciprocal relationship between perceived physical literacy and basic psychological needs satisfaction was discovered in the Taiwan university context (Wang et al., 2020). This result may further suggest the potential of using the achievement goal theory approach in promoting satisfaction through physical education of older adults. Consistent with the literature reviewed above, we have formulated the following specific hypotheses:

H2*: PL affects SAT through IM in a sporting context.*

3.3 PL through SE mediates individuals' IM in sports contexts

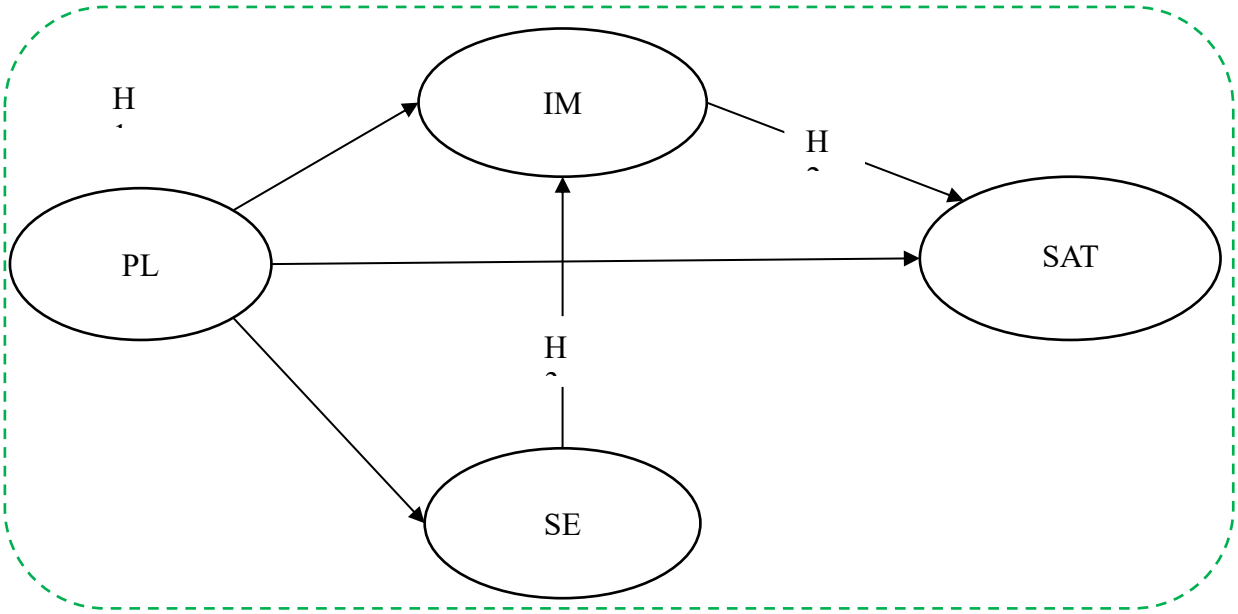
Many previous studies have examined the effects of SE and IM in sports course contexts (Pot et al., 2018; Robinson et al., 2018; Wang et al., 2020) and found them to be important influences. However, in the context of individual learning experiences, the pathways between the variables of PL, SE, and IM have not been examined, constituting a significant research gap. In addition, clarifying the impact of COVID-19 in the context of participation in sports programs will improve our understanding the effectiveness of the learning process and highlight the important value of sports

programs. Consistent with the literature reviewed above, we have formulated the following specific hypotheses:

H3*: SE mediates the influence of PL on IM*

Figure 1

Research Hypothesis



Note. H1 = physical literacy (PL), self-efficacy (SE), intrinsic motivation (IM), and physical activity (PA) are correlated; H2 = physical literacy (PL) influences course satisfaction (SAT) through intrinsic motivation (IM) in physical education (PE) contexts; H3 = physical literacy (PL) and self-efficacy (SE) mediate intrinsic motivation (IM) in individuals.

4. Methods

4.1. Participants and procedures

The participants' mean age was 66.35 years (standard deviation = 4.10), mean height was 157.16 cm (standard deviation = 6.17), and mean weight was 59.32 kg (standard deviation = 8.56). Educational attainment was 46.3% for university and above, 37.0% for high school, and 16.7% for junior high school and below. Of the participants, 46.3% were married, 27.8% had a partner, and 16.7% were widowed. Additionally, 81.5% lived with family members, and 14.8% lived alone. Annual household income ranged from less than $500,000 (29.6%) to $500,000–$1 million (37.0%) and $1.01–$1.5 million (13.0%). Retirees accounted for 64.8% of the participants, and housewives accounted for 29.6%. The online course for this study was conducted at a university in Taiwan from July 1, 2021, to January 31, 2021, using a convenience sampling method and an online database. The classes held three times a week, each session lasting 90 minutes, for a total of 13 sessions. The questionnaires were administered using Google Forms. Questionnaires were distributed from the start date of the course implementation and collected on the last day.

In the first stage, the independent physical literacy and mediated variables (IM and SE) were distributed, and demographic variables were collected. In the second stage, the dependent variable (SAT) was released. A total of 60 questionnaires were distributed, and after eliminating invalid questionnaires (i.e., completed questionnaires in both stages), 54 valid questionnaires remained, giving a valid response rate of 90%. As a result, participants were required to complete the questionnaires in both phases in order to ensure the completeness of the study data. This study employs a cross-sectional design, which allows for data collection from research subjects at a single point in time. The advantage of this design lies in its ability to quickly gather a large amount of data and provide a snapshot of the current situation. However, the cross-sectional design has limitations, such as the inability to determine causal relationships between variables and the inability to capture the dynamic processes of variables over time. Additionally, since the research data is collected at a specific point in time, it may not fully represent the diversity and variability of the sample.

4.2. Measures

The instrument for this study obtained the basic information and participation status of

students in a senior online sports program at a participating university in Taiwan in 2021. The participants were also asked to rate their "physical literacy," "intrinsic motivation," "self-efficacy," "course satisfaction," and "personal information" from 1 (strongly agree) to 5 (strongly disagree). In addition, according to the scale reliability index (Hair et al., 2010), a questionnaire with a reliability coefficient above 0.60 is considered to be a reliable instrument.

Physical literacy. This study referred to the scale developed by Sum et al. (2018) in the study of PL, using the following questions: "I can reach my age-standard level of physical fitness," "I have the ability to self-evaluate my health," and "I have a positive attitude and interest in exercise." The items were measured on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The reliability of the scale was analyzed, and the Cronbach's alpha internal consistency coefficient was .81, which is acceptable (Hair et al., 2010).

Intrinsic motivation. This study referred to the Intrinsic Motivation Inventory developed by Guay et al. (2000) in the context of PA. The items were measured on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Example items include: "I enjoy participating in this activity very much," "I find this activity very interesting," and "I feel a lot of pleasure while doing this activity." The reliability of the scale was analyzed, and the Cronbach's alpha internal consistency coefficient was .95, which is acceptable (Hair et al., 2010).

Self-efficacy. This study referred to the Self-Efficacy in Sports Situations Scale developed by Resnick and Jenkins (2000). The reference questions were as follows: "I still go out to exercise when I am not interested in this sport," "I still go out to exercise if I am not accompanied by friends," and "I still go out to exercise when I am physically tired." The items were measured on a 10-point Likert scale, ranging from 1 (very unconfident) to 10 (very confident). The reliability of the scale was analyzed, and the Cronbach's alpha internal consistency coefficient was .95, which is an acceptable reliability (Hair et al., 2010).

Course satisfaction. This study referred to the scale developed by Moore and Fry (2017) in a contextual satisfaction study of PA. The reference questions were as follows: "I think that it's fun to do sports," "I am fully engaged when doing sports," and "I think

sports are great; I like them." The items were measured on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The reliability of the scale was analyzed, and the Cronbach's alpha internal consistency coefficient was .86, which is acceptable (Hair et al., 2010).

Satisfaction. Originating from the Flanagan scale (1978), the modified scale was adopted to measure health outcomes appraisal. This scale considered the holistic conceptual domains of participants' life, regarding the physical activity context, only five out of 16 statements were selected in this study. Participants answered on a Likert scale of one (terrible) to seven (delighted). Examples statements included: I think that it's fun to do sports". This scale is reliable with internal consistency ($\alpha = 0.82 - 0.92$).

4.3. Statistical analysis

The IBM SPSS Amos 22.0 statistical software was used to process and analyze the data, and the statistical test was conducted with $\alpha = .05$ as the significant level. The analysis methods were descriptive statistics, Pearson's product difference correlation, hierarchical regression, and a structural equation model.

5. Results

5.1. Descriptive statistics and Correlation analysis of various variables

The correlation analysis showed that physical literacy was positively correlated with IM ($r = .40$; $p < .05$), SE ($r = .30$; $p < .05$), and SAT ($r = .42$; $p < .05$). IM was positively correlated with SAT ($r = .50$; $p < .05$). As shown in Table 1, the mean scores for physical fitness, IM, SE, and SAT were 4.57, 6.58, 7.82, and 4.88, respectively.

Table 1

Correlations among study variables

		Number	Percentage			
Gender	Man	8	6.75%			
	Female	46	93.25%			
	M	SD	PL	IM	SE	SAT
PL	4.57	0.44	1.00	.40*	.30*	.42*
IM	6.58	0.49		1.00	.09	.50*
SE	7.82	1.80			1.00	.27
SAT	4.88	0.28				1.00

Note. PL = physical literacy; SE = self-efficacy; IM = intrinsic motivation; SAT = satisfaction; M = mean; SD = standard deviation; $p < .05$. $N = 54$.

5.2. Analysis of mediated effectiveness measurements

The results of the mediated effect test showed that a significant direct effect of IM was found between PL and SAT ($\beta = .16$; $p < .05$) at the 95% confidence level, and a significant indirect effect was observed between the upper and lower bounds of the bias-corrected confidence interval (CI), giving an overall indirect effect of the model ranging from .00 to .29. These findings indicated that IM partially mediated the relationship between PL and SAT. A significant direct effect of IM was found only between PL and SE ($\beta = .45$; $p < .05$), and the upper and lower bounds of the bias-corrected CI for the overall model indirect effect were -.15 to .05, indicating that SE did not mediate PL and IM, as shown in Table 2.

Table 2

Mediated Analysis

Independent	Mediated	Dependent	Path a	Path b	Path c (Direct effect)	95% CI (Indirect effect)
PL	IM	SAT	.44*	.23*	.16*	.00 ~ .29*
PL	SE	IM	1.24*	.01	.45*	-.15 ~ .05

Note. PL = physical literacy; SE = self-efficacy; IM = intrinsic motivation; SAT = satisfaction; M = mean; SD = standard deviation * $p < .05$. $N = 54$. Path a: PL → IM (β = .44*), Path b: IM → SAT (β = .23*), Path c: PL → SAT (direct effect, β = .16*).

6. Discussion

The COVID-19 pandemic has led to the introduction of online teaching and learning in the field of physical education (PE; Chodzko-Zajko et al., 2009; Jones & Rikli, 2002) and sports, yet the feasibility and effectiveness of online learning for senior citizens have rarely been explored (Górnicka et al., 2020). However, This study fills this research gap by exploring the learning experiences of older adults in online exercise courses. Concerning the design and implementation of online courses, the online courses in this study were specifically designed for older adults and included activities such as stretching exercises, strength training, and aerobic exercises. Participants exercised at home and interacted with instructors and other participants through an online platform. This design not only provided flexibility and convenience but also simulated the effects of in-person courses. The results of this study found significant positive correlations between physical literacy (PL), intrinsic motivation (IM), self-efficacy (SE), and course satisfaction (SAT) among older adults in online exercise courses. This indicates that online exercise courses can effectively enhance the PL of older adults, thereby increasing their IM and SE, and improving their satisfaction with the courses. The statistical method of hierarchical regression analysis was used to examine the effects between the variables, and the significant findings are described below.

According to the results, in the online sports course learning context, the PL of

seniors had a positive associated with IM, SE, and SAT; specifically, seniors with higher PL were more active in sports, showed better learning outcomes, and were relatively more satisfied with the course. This result confirmed Wang et al.'s (2020) study, which confirmed that physical fitness is an important factor in the process of motor learning and has a substantial impact on an individual's perception of learning outcomes. In other words, individuals with high physical literacy are more likely to engage in various physical activities and demonstrate higher physical fitness in these activities.

On the other hand, Robinson et al. (2018) suggested that the IM of an individual's participation in motor behavior may also play a role in the effectiveness of the exercise and that its effectiveness is a key factor in whether an individual continues to participate in motor behavior. As mentioned earlier, the H1 of this study was confirmed, as it confirmed the findings of this study (Robinson et al., 2018). At the practical level, older adult communities may improve their physical fitness and demonstrate better SE in the process of exercise learning through participation in online exercise classes, which may enhance their satisfaction level with participation in online exercise classes and encourage them to develop the habit of continuous exercise participation. The abovementioned literature showed that PL is necessary and important for the senior community (Sum et al., 2018; Wang et al., 2020).

Even if online sports courses are used, PL still has a significant impact on seniors' SE and satisfaction with their IM. Therefore, PE and sports instructors should design sound teaching strategies to promote the PL of more senior citizens, which in turn will help them face healthcare issues as they move into an aging society.

Therefore, during exercise, older adults may benefit from engaging in social interactions such as communicating with peers, seeking guidance from instructors, or even teaching others. These social interactions can serve as motivating factors for older adults to participate in exercise activities (Sum et al., 2022). In addition, social interaction plays a crucial role in the exercise experience of the elderly. Considering the importance of social interaction, it is recommended to incorporate selected and specific social elements into the design of physical literacy programs for older adults. In Taiwan, 12-Year Basic Education Core Competency-Based Physical Education Curriculum aims to promote students' physical literacy, with social participation being one of the key principles emphasized during senior high school (Wang et al., 2020).

This indicates that social participation has been recognized and nurtured since childhood in Taiwan, and it should also be extended to the elderly population. Research has shown that social participation and engagement in physical activities can significantly enhance the physical literacy and overall well-being of older adults (Chodzko-Zajko et al., 2009; Jones & Rikli, 2002). The findings of this study further support the idea that fostering social participation among older adults is essential for promoting their physical literacy and overall well-being.

The study of mediating effects has long been valued by academics as an important research method (Hsiao et al., 2020; MacKinnon & Fairchild, 2009). In terms of validating the mediating effects, the results supported Hypothesis 2. The relationship between PL and SAT was partially mediated by an individual's IM, indicating a contribution to the PL of older adults. This result suggested that, to increase the lifelong participation behavior of the senior population, it is necessary to increase the IM of the senior population and grow their PL. Specifically, when senior citizens' motivation to participate in sports is enhanced, their level of satisfaction with sports learning is further augmented. On the other hand, the concept of PL is used in the field of sports as a measure to increase lifelong participation and as the ultimate indicator to optimize the benefits of participation in sports activities. Therefore, the validation of this study revealed that intrapersonal motivation is still influential in the process of strengthening PL among older adults and has been shown to play a key role in mediating the participation of older adults in online sports programs, which is an important finding of this study. More importantly, PL has been an important issue since the 20th century, and it has had a significant impact on education in modern countries, as physical literacy-oriented curriculum reform has become a focus of attention worldwide (Cairney et al., 2019; Chodzko-Zajko et al., 2009; Dudley et al. 2017). The present study validated IM as a mediating variable and tested the existence of a relevant partial mediating effect, which, as previously mentioned, not only provides an application for the health issues of the aging society in Taiwan but also helps to improve the current domestic exercise programs. This finding is also an important value of this study.

This study further identified the mediating effect of individual SE on PL and IM and found that the PL of older adults had significant predictive power on SE and IM, while SE showed no significant predictive effect on IM. It is worth exploring whether,

following the conceptual framework of Deci and Ryan's (2000) theories of motivation, individuals are motivated according to their level of self-determination, which in turn affects their level of motivation and ultimately their intention and behavior to participate in sports. In addition, many factors influence individuals in the learning process, and previous studies have shown that different exercise situations or PA behaviors can enhance individual SE and better athletic performance (Wang et al., 2020). Specifically, according to the motivational theory perspective (Deci & Ryan, 2000), during the motor participation learning process, individuals produce better motor performance through autonomous behaviors and provide psychological support factors for students to practice PAs while satisfying their personal performance.

In the online sports course context, senior individuals' personal physical fitness had significant effects on both SE and IM; however, the senior community had no significant effects on the pathways of SE and IM. This finding confirmed Deci and Ryan's (2000) finding that individuals' learning effectiveness is affected by individual differences in IM, depending on the time lapse and external environmental influences in the motor learning context. The results also provided perspectives for follow-up studies related to online sports course contexts. In addition, this study reaffirmed that the role of PL in the learning process of sports courses is crucial and that developing PL through participation in sports courses can increase IM to engage in healthy PA behaviors and enhance the effectiveness of sports participation (Deci & Ryan, 1985; Whitehead, 2019). Taken together, this study demonstrated that PL plays an important role in the learning context of online exercise classes for older adults, which not only fills an important research gap but also clarifies the specific factors that influence the learning effectiveness of older adults during their participation in online exercise classes.

This study was motivated by the escalating attention to physical literacy in Taiwan's physical education. The current study design covered the domains and attributes of physical literacy in an attempt to identify the relationship between physical literacy and quality of life. In particular, the variables of motivation and satisfaction were found to mediate the relationship between the two primary variables, in the context of older adults physical education. As a practical implementation, physical education practitioners could nurture older adults to be physically literate, i.e., to take

more self-responsibility for participating in lifelong physical activity by endorsing their holistic and unique experiences as well as creating a more empowering and cooperative environment. In employing the PL proposed physical literacy questionnaire, we worked on the assumption that older adults could understand that participating in physical education opens up a world of opportunity for challenging themselves in worthwhile experiences that will contribute to their holistic health and enhance their satisfaction. We envisage that this research into physical literacy could open up future investigation into other population groups.

6.1. Limitations of the study and future research

Despite the valuable insights provided by this study on the role of PL in online exercise courses for older adults, there are still some limitations that need to be addressed. The first is that the study's cross-sectional design limits the generalizability of the findings to other online learning contexts. Therefore, future studies could adopt a longitudinal approach to data collection to gain a more in-depth understanding of the psychological changes in the senior population's participation in online sports courses. A second limitation is the difficulty in collecting data from some senior citizens who were unable to participate in online sports courses due to their poor health conditions. This challenge may have limited the study's sample size and the accuracy of the findings. Lastly, while quantitative research designs can obtain objective and accurate data, they do not always capture the interactions and concerns between people on the ground. Therefore, future research could incorporate qualitative research methods, such as actual observation, interviews, and recordings at the research sites. Additionally, personalized courses should be implemented, designing exercise programs based on the physical condition and interests of older adults. These programs should consider their health status, physical abilities, and personal preferences to ensure they can participate safely and effectively. Practical training should include basic physical fitness training, such as flexibility, strength, endurance, and balance training, all of which are important factors for older adults to maintain their health and live independently. These methods could provide a more microscopic standpoint and help to explore the actual impact of PL on the aging population, ultimately contributing to the improvement of the social issue of healthy aging.

7. Conclusion

This study highlighted the significant role of PL in the online sports course learning experience for seniors, as it can influence their SE, IM, and SAT. The findings indicated that PL is an essential competency for the senior population and is directly linked to maintaining a purposeful pursuit of PA, which is a vital indicator of healthy aging. The study also emphasized the importance of IM as a mediator in the seniors' exercise course learning process. Additionally, the research suggested that PL can directly predict personal SE and IM during the online exercise course learning experience. Therefore, it is essential to develop PL actively in different age groups and to strengthen the PL skills of individuals in older age groups to promote sustained participation in PA behaviors. In summary, this study provided evidence that PL is an important factor in influencing the senior population's engagement in PA behaviors. The findings underscored the need to promote PL skills among older adults to support healthy aging and well-being. The findings also highlighted the significance of IM as a mediator in the exercise course learning process, emphasizing the importance of creating engaging and stimulating environments that foster motivation for sustained participation in PA.

References

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students learning strategies and motivation processes. *Journal of Educational Psychology, 80*(3), 260–267. https://doi.org/10.1037/0022-0663.80.3.260

Bandura, A. (1997). Self-efficacy: The exercise of control. *Journal of Cognitive Psychotherapy, 13*, 158–166.

Boldovskaia, A., Dias, N. M. G., Silva, M. N., & Carraça, E. V. (2023). Physical literacy assessment in adults: A systematic review. *PLOS ONE, 18*(7), e0288541. https://doi.org/10.1371/journal.pone.0288541

Cairney, J., Dudley, D., Kwan, M., Bulten, R., & Kriellaars, D. (2019). Physical literacy, physical activity and health: Toward an evidence-informed conceptual model. *Sports Medicine, 49*(3), 371–383. https://doi.org/10.1007/s40279-019-01063-3

Campelo, A. M., & Katz, L. (2020). Older adults' perceptions of the usefulness of technologies for engaging in physical activity: Using focus groups to explore physical literacy. *International Journal of Environmental Research and Public Health, 17*(4), 1144. https://doi.org/10.3390/ijerph17041144

Chodzko-Zajko, W. J., Proctor, D. N., Singh, M. A. F., Minson, C. T., Nigg, C. R., Salem, G. J., & Skinner, J. S. (2009). Exercise and physical activity for older adults. *Medicine & Science in Sports & Exercise, 41*(7), 1510–1530. https://doi.org/ 10.1249/MSS.0b013e3181a0c95c

Cornish, K., Fox, G., Fyfe, T., Koopmans, E., Pousette, A., & Pelletier, C. A. (2020). Understanding physical literacy in the context of health: A rapid scoping review. *BMC Public Health, 20*, 1569. https://doi.org/10.1186/s12889-020-09583-8

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality,19*(2), 109–134. https://doi.org/10.1016/0092-6566(85)90023-6

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational psychologist, 26*(3-4), 325–346. https://doi.org/10.1080/00461520.1991.9653137

Dudley, D., Cairney, J., Wainwright, N., Kriellaars, D., & Mitchell, D. (2017). Critical considerations for physical literacy policy in public health, recreation, sport, and education agencies. *Quest, 69*(4), 436–452. https://doi.org/10.1080/00336297.2016.1268967

Flanagan, J. C. (1978). A research approach to improving our quality of life. *American Psychologist, 33*(2), 138–147. https://doi.org/10.1037/0003-066X.33.2.138

Górnicka, M., Drywień, M. E., Zielinska, M. A., & Hamułka, J. (2020). Dietary and lifestyle changes during COVID-19 and the subsequent lockdowns among Polish adults: A cross-sectional online survey PLifeCOVID-19 study. *Nutrients, 12*(8), 2324. https://doi.org/10.3390/nu12082324

Guay, F., Vallerand, R. J. & Blanchard, C. (2000). On the assessment of situational intrinsic and extrinsic motivation: The situational motivation scale (SIMS). *Motivation and Emotion, 24*(3), 175–213. https://doi.org/10.1023/A:1005614228250

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2010). *Multivariate Data Analysis* (7th ed.). New York.

Hsiao, C. H., Wang, F. J., & Lu, Y.-C. (2020). Development of sustainable marathon running: A perspective of consumer socialization. *Sustainability, 12*(18), 7776. https://doi.org/10.3390/su12187776

Jones, C. J., & Rikli, R. E. (2002). Measuring functional fitness of older adults. *The Journal on Active Aging, 1*, 24–30.

Koolhaas, C. M., Dhana, K., van Rooij, F. J. A., Schoufour, J. D., Hofman, A., & Franco, O. H. (2018). Physical activity types and healthrelated quality of life among middle-aged and elderly adults: The Rotterdam study. *The Journal of Nutrition, Health & Aging, 22*(2), 246–253. https://doi.org/10.1007/s12603-017-0902-7

MacKinnon, D. P., & Fairchild, A. J. (2009). Current directions in mediation analysis. *Current Directions in Psychological Science, 18*(1), 16–20. https://doi.org/10.1111/j.1467-8721.2009.01598.x

Moore, E. W. G., & Fry, M. D. (2017). Physical education students' ownership, empowerment, and satisfaction with PE and physical activity. *Research*

Quarterly for Exercise and Sport, 88(4), 468–478. https://doi.org/10.1080/02701367.2017.1372557

Nicholls, J. G. (1984). Achievement motivation: Connections of ability, subjective experience, task choice and performance. *Psychological Review, 91*, 328–346. https://doi.org/10.1037/0033-295X.91.3.328

Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology, 71*, 225–242. https://doi.org/10.1080/10413200903036040

Perlman, D. (2013). The influence of the social context on students in-class physical activity. *Journal of Teaching in Physical Education, 32*(1), 46–60. https://doi.org/10.1123/jtpe.32.1.46

Petrusevski, C., Morgan, A., MacDermid, J., Wilson, M., & Richardson, J. (2021). Framing physical literacy for aging adults: An integrative review. *Disability and Rehabilitation, 44*(26), 8149–8160. https://doi.org/10.1080/09638288.2021.2012841

Pot, N., Whitehead, M. E., & Durden-Myers, E. J. (2018). Physical literacy from philosophy to practice. *Journal of Teaching in Physical Education, 37*(3), 246–251. https://doi.org/10.1123/jtpe.2018-0133

Reed, J., & Ones, D. S. (2006). The effect of acute aerobic exercise on positive activated affect: A meta-analysis. *Psychology of Sport and Exercise, 7*, 477–514. https://doi.org/10.1016/j.psychsport.2005.11.003

Resnick, B., & Jenkins, L. S. (2000). Testing the reliability and validity of the Self-Efficacy for Exercise scale. *Nursing Research, 49*(3), 154–159. https://doi.org/10.1097/00006199-200005000-00007

Rheinberg, F., & Vollmeyer, R. (2018). *Motivation* (9th ed.). Kohlhammer.

Robinson, Daniel B, Lynn Randall, and Joe Barrett. (2018). Physical literacy (Mis) understandings: What do leading physical education teachers know about physical literacy? *Journal of Teaching in Physical Education, 37*(3), 288–298. https://doi.org/10.1123/jtpe.2018-0135

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychology, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Sum, G., Nicholas, S. O., Nai, Z. L., Ding, Y. Y., & Tan, W. S. (2022). Health outcomes and implementation barriers and facilitators of comprehensive geriatric assessment in community settings: A systematic integrative review. *BMC geriatrics, 22*(1), 379. https://doi.org/10.1186/s12877-022-03024-4

Sum, R. K., Cheng, C. F., Wallhead, T., Kuo, C. C., Wang, F. J., & Choi, S. M. (2018). Perceived physical literacy instrument for adolescents: A further validation of PPLI. *Journal of Exercise Science & Fitness, 16*(1), 26–31. https://doi.org/10.1016/j.jesf.2018.03.002

Wang, F. J., Chen, M. Y., Cheng, C. F., & Sum, K. W. R. (2020). Temporal precedence of physical literacy and basic psychological needs satisfaction: A cross-lagged longitudinal analysis of university students. *International Journal of Environmental Research and Public Health, 17*(12), 4615. https://doi.org/10.3390/ijerph17124615

Whitehead, M. (2019). *Physical literacy across the world*. Routledge.

Yamada, M., Kimura, Y., Ishiyama, D., Otobe, Y., Suzuki, M., Koyama, S., Kikuchi, T., Kusumi, H., & Arai, H. (2020). Effect of the COVID-19 epidemic on physical activity in community-dwelling older adults in Japan: A cross-sectional online survey. *The Journal of Nutrition, Health & Aging, 24*(9), 948–950. https://doi.org/10.1007/s12603-020-1424-2

作者簡介

第一作者：黃貴樹 (通訊作者)

服務單位：淡江大學體育事務處 副教授

通訊地址：新北市淡水區英專路 151 號

聯絡電話：02-2621-5656#2151

E-mail：138490@mail.tku.edu.tw

第二作者：陳逸政

服務單位：淡江大學體育事務處 教授

Journal of Taiwan
Sport Pedagogy
2024, 19(2), 1-24
https://doi.org/10.6580/JTSP.202411_19(2).0001

探討身體素養在 COVID 後疫情時代老年人參與體育運動中的角色

淡江大學體育事務處 **黃貴樹**
淡江大學體育事務處 **陳逸政**

摘　要

COVID-19 疫情爆發對日常生活各方面包括身體活動 (PAs) 和健康產生了重大影響，導致各層級和各領域，包括運動和體育 (PE) 線上教學的引入。因此本研究欲探討老年人參與線上體育運動課程的學習環境，其身體素養 (PL)、自我效能 (SE)、內在動機 (IM) 和課程滿意度 (SAT) 之間的關係。本研究採用便利抽樣 (convenience sampling)，蒐集 2021 年臺灣某大學參與老年人線上運動課程的 60 份問卷資料，以描述性統計、皮爾森相關係數和分層回歸進行統計分析。結果顯示，身體素養與內在動機、自我效能、和課程滿意度有正相關。此外，內在動機是運動情境中身體素養與課程滿意度之間潛在的中介變項。然而自我效能在身體素養與個人內在動機中介效果並不顯著。根據研究證據指出，身體素養與自我效能、內在動機直接相關，而且經由老年人的內在動機狀態以增強對體育運動課程的滿意度。因此，積極加強老年人的身體素養，並積極鼓勵他們持續參與身體活動，將會是健康高齡化的重要指標。

關鍵詞：自我效能、內在動機、遠距教學、中介效應、慢性疾病