



PHYSICAL ACTIVITY AND COGNITIVE FUNCTION FOR A HEALTHIER LEARNING ENVIRONMENT IN SANDWICH PROGRAMMES: IMPLICATIONS FOR ADULT EDUCATION PRACTICE

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Abstract:

The importance of physical activity as a tool to improve cognitive function, mental health and academic performance in adult learners has emerged. The importance of physical activity in building a conducive learning environment is often overlooked, as attention has been primarily focused on adult learners taking courses in a sandwich programme in Nigeria. The paper surveyed the empirical and theoretical literature relating to physical activity, cognitive function, emotional health, and healthier learning environments of adult learners within adult education, in the case of sandwich programmes at Federal University Oye-Ekiti, Ekiti, Nigeria. The paper used a conceptual and theoretical approach. Relevant published peer-reviewed journal articles, policy documents, and academic publications were obtained from the following databases: Google Scholar, Scopus, and PubMed. The study adopted the theoretical model of Cognitive Load theory by Sweller. The findings of the literature review suggest that physical activity influences memory, attention, executive functioning, emotional regulation, stress management, and academic performance. The study also identified that sandwich programmes with physical activity have the potential to improve learning and well-being of adult learners. The paper concludes that the inclusion of physical activity into adult education would make a difference for health learning environments. The paper suggests the provision of institutional wellness programmes, flexible learning environments, accessible recreational facilities, and structured wellness programmes for adult students in sandwich programmes.

Keywords:

Physical Activity, Cognitive Function, Adult Education, Sandwich Programmes, Mental Health.

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INTRODUCTION

Physical activity is an essential component of human existence and healthy living. It is a bodily movement produced by skeletal muscles that requires energy and contributes significantly to physical, mental, emotional, and social well-being. Physical activity includes activities; walking, cycling, gardening, recreation, and sports (WHO, 2020). Researchers' and health practitioners have recognised physical activity as an important intervention for promoting healthy living, preventing chronic illnesses, and improving cognitive function.

Physical activity contributes positively to both physical and psychological health. Studies have linked physical activity with reduced risks of obesity, diabetes, hypertension, depression, anxiety, and cognitive decline (Loprinzi, 2019). Also, physical activity was associated with improved executive functioning, concentration, memory retention, emotional stability, and academic achievement (Rodriguez-Ayllon et al., 2019; Peiris et al., 2022).

Cognitive function is mental processes that support learning, problem-solving, memory, reasoning, attention, language development, and decision-making (Fisher et al., 2019). These cognitive processes are fundamental to effective learning and academic outcomes. However, cognitive ability decreases with age, particularly with older adults, who are likely to experience difficulties in memory, attention and information processing (Van Hooren et al., 2007; Salthouse, 2009). This decline is a major public health burden due to the growing incidence of dementia and other neurodegenerative diseases in elderly demographics (Livingston et al., 2017).

In adult education, particularly in a sandwich programme, cognitive function is of great importance to adult learners who frequently have to balance studies with other responsibilities. Sandwich programmes are flexible educational programmes designed to accommodate working adults by combining classroom learning with professional practice (Dei & Peprah, 2021). These programmes provide educational opportunities for adults, the demands associated with combining employment with family life and academic activities often expose learners to stress, fatigue, and cognitive overload.

Adult learners enrolled in sandwich programmes frequently experience multiple responsibilities associated with employment, family obligations, and academic activities. These responsibilities expose adult learners to stress, fatigue, concentration, emotional pressure, and cognitive overload, and negatively affects their academic outcomes and emotional well-being. Physical activity has is as an important strategy for improving cognitive function, mental health, and academic engagement, its integration into adult education programmes in Nigeria remains limited.

Adult learners in sandwich programmes constitute a heterogeneous group with diverse identities, abilities, and constraints. Research demonstrates that gender, socioeconomic status, cultural background, disability status, and family responsibilities significantly influence access to and participation in any physical activity (Eime et al., 2013). This paper advocates and suggests interventions that acknowledge these intersectional dimensions, ensuring that wellness programmes do not inadvertently and unintentionally exclude or marginalize vulnerable populations within the adult learner population.

Previous studies on physical activity have largely focused on children, adolescents, athletes, and elderly populations in Western countries; limited studies have examined its relevance among adult learners in Nigerian sandwich programmes. There is little or no conceptual literature relating physical activity, cognitive function, and a healthier learning environment within adult education practice, thereby adult learners in sandwich programmes continue to experience poor concentration, stress, low academic engagement, and cognitive fatigue without adequate institutional support for physical activity and emotional well-being.



Despite the benefits of physical activity, there is limited academic attention to the integration of physical activity into adult education practice in Nigeria. Most existing studies on physical activity and cognitive functioning have focused largely on western countries with focus on children, adolescents, athletes, and older adults, with limited emphasis on adult learners in Nigerian sandwich programmes. This represents an important gap in the literature.

This paper, therefore, addresses this gap by examining how physical activity can enhance cognitive function and contribute to a healthier learning environment among adult learners in sandwich.

Objectives of the Study

The objectives of this paper are to:

- i. examine the concept of physical activity and cognitive functioning among adult learners;
- ii. explore the relationship between physical activity and cognitive function in adult education;
- iii. examine the implications of physical activity for healthier learning environments in sandwich programmes;
- iv. discuss the implications of physical activity for adult education practice; and
- v. provide recommendations for integrating physical activity into sandwich programmes at Federal University Oye-Ekiti (FUOYE).

Conceptual Review Method

This research utilises theoretical and conceptual approaches. We identified the relevant literature through peer review journal articles, books, conference proceedings, and policy documents from institutions in the areas of physical activity, cognitive function, adult education and learning environments. The search databases were Google Scholar, Scopus, PubMed and ResearchGate.

The review was based on literature between 2000 and 2025. The selected studies were assessed through thematic and conceptual synthesis (Thomas & Harden 2008). Ten themes were identified: physical activity and memory, executive functions, emotional well-being, academic involvement, stress relief, a healthier learning environment.

Theoretical Framework

This research is based on Sweller's Cognitive Load Theory (CLT) propounded by John Sweller in 1988. Theory provides an account of how the human cognitive system processes information when people learn. The working memory has limited capacity, and excessive cognitive load has a negative impact on students' learning according to this theory.

There are three main sources of cognitive load identified in Cognitive Load Theory:

Intrinsic Cognitive Load: This is the difficulty of the content being taught.

Extraneous cognitive load: The unnecessary mental load on the learner is working memory due to poor pedagogy or a stressful environment.

Germane Cognitive Load: It is a cognitive process related to meaningful learning and schema formation

The theory has particular relevance for adult learners on a sandwich programme, who typically combine study, work, and family responsibilities. This may lead to higher stress, mental fatigue and cognitive overload, making it difficult for adult learners to focus, learn, and perform. It is very important to engage in physical activity to relieve cognitive overload and promote learning efficiency. Physical activity may reduce extraneous cognitive load and increase germane cognitive



load processing. As a result, adult learners are enabled to more effectively process the information and better engage in the learning activities that shape their access to knowledge. Cognitive Load Theory enables a better understanding of how physical activity may promote positive cognitive outcomes and provide a more conducive learning environment for adult learners in the sandwich programme.

Literature Review

Concept of Physical Activity

Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure (WHO, 2020). It includes exercise as well as other activities that involve bodily movement and done as part of playing, working, active transportation, house chores and recreational activities. Exercise is a subcategory of physical activity, which is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness.

The potential of physical activity as a nonpharmacological means to enhance physical health, psychological well-being, and cognitive performance is widely recognized. McCarthy et al. (2021) stated that moderate exercise has positive effects on emotional, social, sleep, and well-being. Nevertheless, sedentary behaviour or lack of physical activity have been associated with obesity, cardiovascular diseases, anxiety and depression, and a decline in cognitive functions.

Physical activity also play a major role in social well-being, as it is reported to enhance self-esteem, social ties, and emotional strength. As a result, physical activity is now being actively encouraged in schools and workplaces as a means to boost productivity, attention and overall well-being. The benefits of physical activity are far-reaching and cover both the prevention and the management of long-term conditions. The British Heart Foundation (2016) research supports the use of physical activity to prevent ill health and reduce the number of people dying prematurely, enhance mental health, quality of life and self-reported wellbeing, delay the need for care in older adults (65+) and reduce health inequalities and improve wider factors influencing health and wellbeing. Physical activity helps prevent many major non-communicable diseases (NCDs). Children and adolescents who are physically active have a better chance of being healthy adults. Physical activity also improves concentration, self-esteem and school performance (2015).

Cognitive Function among Adult Learners

Memory is a critical component of mental ability and has demonstrated to influence participation in physical activity. Evidence shows that several forms of PA, such as aerobic can improve both memory and executive function in older adults who suffer from age-related cognitive impairment. Cognitive functioning involves the ability to perceive and react, process and understand, make decisions and produce appropriate responses to the environment (Morley et al., 2015). It is the mental processes involved in learning, memory, reasoning, problem solving, language, perception, and attention (Fisher et al., 2019). These abilities are essential for academic achievement and effective learning. Although there is little doubt cognitive ability plays a role in determining educational attainment, a variety of evidence has suggested that schooling has an important effect on cognitive performance (Alwin & McCammon, 2001).

Adult learners who enrolled in sandwich programmes often experience cognitive challenges associated with aging, occupational stress, and family responsibilities. Salthouse (2009) shown that aging is associated with gradual declines in working memory, attentional capacity, processing speed, and executive functioning. These challenges may affect adult learners' ability to concentrate, retain information, and participate actively in academic activities. Adult students commonly experience stress and anxiety from having to combine work and family obligations with their educational

engagement. The stress may have negative impacts on their mood, motivation, and participation in learning activities.

Physical Activity and Cognitive Function

The effect of physical activity on cognitive function has been discussed in recent years. Studies have shown that physical activity positively affects memory, attention, executive function, information processing, and emotion regulation. Participation in physical activities is a salient determinant of the adults' health, especially those aged 60 years and above. Physical activity is crucial in slowing the ageing of the brain. A structured physical activity programme in adult individuals improves cognition by modulating the transport of substances important for emotional regulation and neuronal communication across the blood-brain barrier. The benefits of physical activity are more pronounced when adults engage in social and productive leisure activities.

An important mechanism by which physical activity benefits cognition is through neuroplasticity. Cotman and Berchtold (2002) assert that Physical activity induces the release of brain-derived neurotrophic factor (BDNF), which promotes the growth and survival of neurons and synaptic plasticity. This is a major contributor to the processes of learning and memory. Physical activity, particularly aerobic exercise, has been associated with increased blood flow and oxygen to the brain, leading to improved functioning of the hippocampus and memory (Ratey & Loehr, 2011). Ballesteros et al. (2024) demonstrated that episodic memory and executive functioning in older adults are enhanced by physical activity.

PA also boost performance in executive functions, such as planning, decision-making, attentional control, and problem solving. Guiney & Machado (2013) stated that the improvements with exercise might be mediated through enhancements to the prefrontal cortex, which is involved in higher-order cognition. People who participate frequently in physical activity show improved attention and greater mental adaptability (de Greeff et al. (2018).

Physical Activity and Mental Health

Physical activity is widely recognised for its benefits to physical health, but its positive effects on mental health are equally significant. Regular movement can improve mood, reduce symptoms of anxiety and depression, and enhance overall cognitive function. A 2018 meta-analysis of over 260,000 participants found that individuals who engaged in regular physical activity had significantly lower odds of developing depression compared to those who were inactive

(Schuch et al., 2018). This is in addition to other health benefits, including lower all-cause mortality, a lower incidence of hypertension and type 2 diabetes, a lower incidence of multiple types of cancer, and a reduced risk of excessive weight gain, among others. Especially as we age, physical exercise allows us to improve or maintain physical function and reduce the incidence of falls and fall-related injuries. Aerobic exercise has been shown to increase the size of the hippocampus, a brain region critical for memory and learning, even in older adults (Erickson et al., 2011).

Mental health is a key determinant of academic engagement and cognitive performance in adult learners. Challenging academic, work, and family responsibilities place many adult learners under pressure, leading to anxiety, emotional exhaustion, and depression. Physical activity has a positive effect on mental health, decreasing anxiety, depression, and psychological distress (Biddle & Asare, 2011). It also encourages the production of endorphins and other chemicals in the brain that influence positive mood and emotional health. Regular physical activity enhances emotional resilience and stress management, which enables adult learners to face academic adversity. Smith et al. (2010) reaffirm that emotional well-being and cognitive function were enhanced following physical activity.



Integrating Physical Activity into Adult Education Programmes

Promoting physical activity within adult education programmes promotes adult learners' cognitive functioning, emotional well-being, and educational outcomes. Brief physical activity during lectures might be effective in counteracting fatigue and improving attention (Wilson et al., 2016). Flexible learning environments may also encourage physical activity. Universities, particularly offering sandwich programmes or courses, can design the learning environment to promote movement through seating plans, standing desks and play areas. Wellness programmes may also be introduced, such as fitness classes, recreational sports and stress management workshops. These efforts can motivate adult learners to make healthier choices in life and become more involved in their academics.

Cultural and Contextual Adaptations for Nigerian Sandwich Programmes

Physical activity interventions must be culturally appropriate and contextually situated in Nigeria. In the Nigerian context, research on wellness interventions in higher education remains nascent and budding, requiring attention to local values, religious considerations, and available resources (Omokhabi, 2025). For instance, structured fitness activities such as circuit training, lap swimming, yoga sessions, and interval training (HIIT), as well as organized sports like football or tennis, must always accommodate Islamic prayer times and religious observances. Additionally, many Nigerian institutions operate with limited infrastructure, necessitating creative, low-cost interventions such as walking groups, community sports, and movement-based learning activities that do not require any expensive equipment, facilities, or experience. Culturally-informed wellness education should celebrate indigenous and native movement practices and integrate traditional Nigerian approaches to physical well-being alongside evidence-based interventions. This culturally-responsive approach increases the relevance, applicability, and sustainability of interventions while respecting the lived experiences and values of Nigerian adult learners.

Gap in Literature

Few studies have investigated the association between physical activity and cognitive function; most of these have concentrated on children, adolescents, athletes, and older adults in Western countries. In addition, there is no sufficient literature that connects physical activity, cognitive functioning and a healthier learning environment in the context of adult education practice in Nigeria. There is also limited theoretical literature that connects physical activity, cognitive functioning and a healthier learning environment in the context of practice of adult education in Nigeria. This paper, therefore, explores the gap in the literature by exploring the implications of physical activity for cognitive functioning and healthier learning environments for adult learners in sandwich programmes.

Strategies for Integrating Physical Activity into Adult Education Programmes.

Incorporating Movement Breaks into the Curriculum: One of the simplest methods to include physical activity in adult education is to incorporate movement within the curriculum. This can be accomplished using different strategies, including active learning techniques that require physical movement during educational sessions. Facilitators could employ group work, role-playing, and interactive exercises to motivate students to move around the classroom. These breaks might include stretching, moving around the classroom, dancing, or light exercises. Standing desks or mobile furniture in classrooms and libraries enables students to walk around while learning.

Designing Flexible Learning Environments: Another important aspect of incorporating physical exercise into adult education programmes is the creation of flexible learning environments. This includes creating spaces that facilitate easy movement, such as classrooms with seating



arrangement that can be adjusted. Additionally, providing students with access to close fitness centers on campus may motivate them to incorporate exercise into their everyday routines (Smith & Lee, 2023). Flexible learning settings might also utilize technology that encourages physical activity. These types of programmes are designed to meet the needs and preferences of the adult learner population and include options for a variety of fitness levels and availability (Brown & Davis, 2023).

Educational institutions may also promote PA through informal social gatherings (such as wellness programmes), motivational workshops, and fitness challenges. When students participate in the various types of events, they will increase their awareness of the benefits of PA and encourage them to adopt a healthier lifestyle. In addition to improving cognitive functioning, wellness programmes have been shown to have a beneficial impact on mental health and overall quality of life” (Terrell et al., 2023; Morgan et al., 2023).

Benefits of a Healthier Learning Environment

Adult learners who participate in a healthier learning environment that combines PA and encourages mental well-being will gain a number of benefits. These benefits include increased cognitive abilities, improved academic performance, improved psychological well-being and increased engagement in learning. Providing a healthy, active learning environment will be particularly important for adult learners enrolled in sandwich programmes who have difficulty managing multiple responsibilities.

Enhanced Cognitive Function: A more positive learning environment along with regular PA has proven to improve brain function. Engaging in PA boosts several aspects of cognitive performance, but not limited to memory, attention, and executive functions (George et al., 2023). For adult learners, particularly those facing challenges due to age (cognitive decline) or those who are managing the demands of academic and work create improvements in cognitive functioning that are extremely helpful. Enhanced cognitive functioning allows for increased information processing and problem-solving abilities all of which are critical for academic success. (Kekäläinen et al., 2023).

Improved Mental Health and Well-being: A healthy learning environment has proven to improve mental health and general quality of life. Exercise has been shown to decrease stress, anxiety, and depressive symptoms, which are prevalent in adult learners attending demanding programmes. Adult education programmes can assist learners at managing stress and maintaining positive mental health by offering PA as an integrated part of the course (Smith et al., 2010). Improved mental health is associated with increased motivation, positive mood, and participation in academics. Stress management is also important for adult learners in sandwich courses.

Increased Academic Performance and Engagement: Learners perform better and are more engaged when they are in a healthier environment that supports PA and mental health. PA improves cognitive function and also increases energy and reduces fatigue so that learners can be more active and engaged during their studies. A positive learning environment also promotes active learning and builds community within the learning group. This engagement can result in a more collaborative and motivating academic experience, where learners are more likely to interact with peers, seek help when needed, and actively contribute to their learning process (Chickering & Kuh 2005).

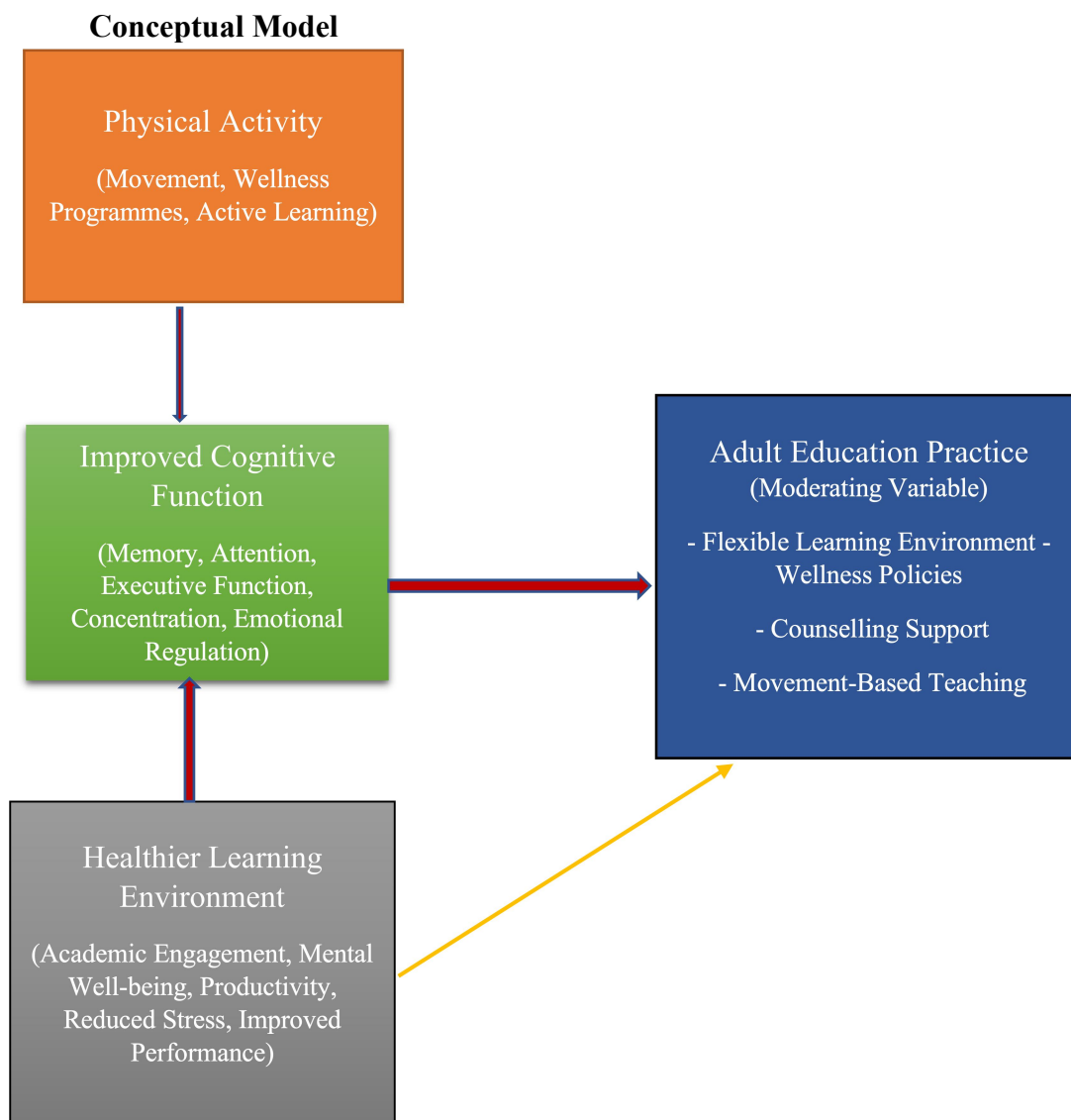


Figure 1: Conceptual Model for Physical Activity on Cognitive Function for a Healthier Learning Environment in FUOYE Sandwich Programme: Implications for Adult Education Practice
Source: Researcher's Construct 2026

The conceptual model illustrates how physical activity, cognitive function, and a better learning environment are related; with adult education, practices influence these relationships. PA affects cognitive functioning as well as the formation of an improved learning environment. Cognitive function acts as an intermediary between PA and a healthier learning space, while techniques used in adult education modulate the effect of cognitive function on the learning environment. This modulation has the potential to either enhance or diminish the nature of this relationship.

The independent variable is physical activity, the mediating variable is cognitive functioning, the moderating variable is Adult education practice, and the dependent variable is a healthier learning environment. The conceptual model of this study shows the relationship between physical



activity, cognitive functioning, adult education practice, and healthier learning environments. The model proposes that physical activities enhances memory, attention, executive functioning, and emotional regulation and stress management. This enhanced cognitive performance then helps foster healthier learning environments, characterised by increased academic engagement, concentration, emotional well-being, and productivity.

Implications for Adult Education Practice

Adult education and learning have gone through significant developments. It has evolved from a second chance opportunity for illiterate adults to learn basic literacy and numeracy to an all-embracing platform that provides education for people of all ages, promoting lifelong and inclusive learning (CONFINTEAVI; Mid Term Review 2017 in Ojokheta & Omokhabi, 2018). Adult learners are a unique group of learners who face several learning challenges and responsibilities that come with adulthood (Ojokheta, Oladeji, & Omokhabi, 2016). Adult individuals frequently engage in educational pursuits for various personal or for a career-related. Although many learners return with the intent to enhance their employment opportunities, for some, the educational journey serve as a life-changing event that fosters personal advancement, boosts intellectual growth, promotes their self-worth, and enhances confidence (Higher Education Today, 2019 in Omokhabi, 2025). Integrating physical activity into adult education programmes and the environment significantly affects adult learners, particularly those enrolled in sandwich programmes at educational institutions like Federal University Oye-Ekiti (FUOYE). These implications influence their academic and personal lives, promoting their learning experience and well-being. Below is how physical activity can influence adult education practice.

Increased cognitive function and academic achievement.

Physical activity plays a major role in memory, attention, concentration, and executive functioning. Regular physical activity for adult learners can lead to increased academic productivity and learning. Physical activity also improves working memory and information processing, which is crucial for adult learners completing complex academic tasks and work-related tasks (Cassilhas et al., 2016).

Improved Mental Health and Emotional Well-being

Adult learners often suffer from stress and emotional fatigue because of work, family and academic demands. Exercise helps to lower levels of stress, anxiety and depression, which promotes emotional stability. Enhanced emotional health can boost learners' motivation, self-confidence and engagement in learning.

Better Time Management and Work/Life Balance.

Exercise has been linked to better self-control, planning and time management (Singh & Staines, 2015). The physically active lifestyle of adult learners might make them more capable of managing academic, occupational, and family demands.

Improved Students' Motivation and Academic Engagement.

Engaging in physical activity programmes can help to build relationships, teamwork and belongingness among learners (Eime et al., 2013). More engagement might improve classroom involvement and learning motivation.

Long-Term Health Benefits

Physical activity benefits the body in the long-term by decreasing the risk of chronic diseases (including hypertension, obesity, diabetes and cardiovascular diseases). Long-Term Health Benefits Regular physical activity promotes long-term physical and mental health by reducing risks associated with chronic diseases such as hypertension, obesity, diabetes, and cardiovascular diseases.



Promotion of Physical Activity in Sandwich Programmes: Implications for FUOYE

The institutions with sandwich programmes, especially Federal University Oye-Ekiti (FUOYE), should have institutional policies to encourage a healthy lifestyle and physical activity amongst the adult learners.

Wellness education should be incorporated into the curriculum of sandwich programmes, and active learning should be promoted. Brief physical activity sessions may also be incorporated into lectures and workshops.

Furthermore, universities should have easily accessible recreational facilities, fitness and sports centres, and wellness programmes for adult learners that fit their schedules.

Conclusion

Physical activity is an effective strategy for enhancing cognitive functioning, emotional well-being, academic engagement, and overall learning outcomes among adult learners. Regular participation in physical activity improves concentration, memory, emotional resilience, productivity, and academic performance. Consequently, institutions offering sandwich programmes, such as the Federal University Oye-Ekiti (FUOYE), should promote physical activity through supportive policies, wellness programmes, accessible recreational facilities, wellness education, movement breaks during lectures, counselling services, and periodic time management training to foster healthier and more productive learning environments.



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