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The Foundation of Physical Activity Behavior: A Social Cognitive Theory Lens on Assessment, Predictive Power, Theoretical Validity, and the Sources of Self-Efficacy.

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"If the huge benefits of a few key lifestyle habits were put into a pill, it would be declared a spectacular breakthrough in the field of medicine" (Bandura, 2000, p. 299).

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List of Abbreviations

EU	European Union
IPAQ	International Physical Activity Questionnaire
OECD	Organisation for Economic Co-operation and Development
MVPA	moderate-to-vigorous physical activity
NCD	noncommunicable disease
SEM	structural equation model
SCT	Social Cognitive Theory
UN	United Nations
WHO	World Health Organization

List of Original Publications

This dissertation follows a publication-oriented approach (German: publikationsorientierte Dissertation) and is based on three articles and two manuscripts currently submitted for publication. All included publications and manuscripts are first-authored by the author of this dissertation. The most recent version of all publications and manuscripts is included, although minor changes may occur based on formatting.

(1) **Egele, V. S.,** & Stark, R. (2024). Operationalization of the social cognitive theory to explain and predict physical activity in Germany: A scale development. *Frontiers in Sports and Active Living*, *6*, 1508602. https://doi.org/10.3389/fspor.2024.15086

(2) **Egele, V. S.,** Klopp, E., & Stark, R. (2025). How Valid Is Bandura's Social Cognitive Theory to Explain Physical Activity Behavior?. *European Journal of Investigation in Health, Psychology and Education*, *15*(2), 20. https://doi.org/10.3390/ejihpe15020020

(3) **Egele, V. S.,** & Stark, R. (2025). Social Cognitive Theory and Physical Activity: Examining Gender-Based Prediction Patterns and Theoretical Validity. *Sports*, *13*(8), 249. https://doi.org/10.3390/sports13080249

(4) **Egele, V. S.,** Klopp, E., & Stark, R. (2025). An Empirical Ranking of the Importance of the Sources of Self-Efficacy for Physical Activity. *Health Psychology and Behavioral Medicine*, *13*(1). https://doi.org/10.1080/21642850.2025.2567322

(5) **Egele, V. S.,** & Stark, R. (accepted). A latent profile analysis of the sources of physical activity-specific self-efficacy. Manuscript submitted for publication to *Health Psychology Open*.

Summary

Physical inactivity has become a growing concern in recent years, with the World Health Organization asserting that this issue necessitates structural changes at the political and societal levels as well as behavioral changes at the individual level. To achieve the latter, an understanding of the theoretical basis of behavior is crucial. Albert Bandura's prominent Social Cognitive Theory can be utilized to elucidate physical activity behavior, positing that physical activity behavior is influenced by both social factors (e.g., the social environment, place of residence, and road safety) and cognitive factors (e.g., self-efficacy [belief in one's capability of a particular behavior], outcome expectations [anticipated positive and negative consequences of a behavior], and goal setting). While Social Cognitive Theory has frequently been applied across various health behavior domains, it has been critiqued as it has seldom been examined in its totality; instead, it is typically analyzed and applied in parts. Consequently, the first objective of this dissertation was to address this gap by conducting a corresponding holistic model test of Social Cognitive Theory in relation to physical activity behavior and examining the validity of its theoretical assumptions.

The second objective was to gain a better understanding of the development of self-efficacy beliefs. Social Cognitive Theory suggests that self-efficacy exerts a distinctive influence on behavior both directly and indirectly through its effects on outcome expectations, socio-structural factors, and goals which in turn affect behavior. Consequently, a substantial body of work has focused on the impact of self-efficacy. However, there is a paucity of research addressing the *origins* of self-efficacy beliefs. Bandura advanced the concept of self-efficacy in accordance with the tenets of Social Cognitive Theory, proposing that its genesis can be attributed to four distinct sources: personal experience, vicarious experience, persuasion, and affective states. A common assumption is that these sources are not equally relevant and exist within a hierarchical structure; however, this hierarchy of the sources of self-efficacy has not been empirically verified. Therefore, it remains unclear whether such a hierarchy of relevance exists and what form it might take. Furthermore, despite studies indicating potential covariation among these sources, extant research on self-efficacy has predominantly focused on each source individually, thereby missing a holistic examination of the sources of self-efficacy. Consequently, systematic differences in the characteristics of these sources across individuals remain uncertain, but could provide a foundation for interventions based on the sources of self-efficacy.

Five research projects were carried out to address these overarching research objectives. The first project involved developing a questionnaire to enable the concurrent evaluation of self-efficacy, outcome expectations, socio-structural factors, and goals in relation to general physical activity behavior. The development and validation of this 18-item questionnaire were particularly relevant because previous research based on Social Cognitive Theory has been hindered by the lack of validated measures. However, considering the questions regarding the validity of Social Cognitive Theory's theoretical assumptions, it seemed very important to measure the constructs as accurately as possible. Consequently, the objective of Publication 1 was to develop and validate the questionnaire assessing the elements of Social Cognitive Theory. Following questionnaire development, in the second and third research project, a structural equation model was used to evaluate the validity of Social Cognitive Theory's underlying theoretical assumptions, in both the overall sample (Publication 2) and for men and women separately (Publication 3). Both studies demonstrated that the theoretical assumptions were valid. Despite identifying minor discrepancies in the mechanisms of action of Social Cognitive Theory's distinct components, the overall validity of its theoretical assumptions was substantiated.

The fourth research project addressed the sources of self-efficacy, examining their relative relevance. The results of a relative importance analysis (Publication 4) indicated that mastery experience, along with verbal self-persuasion and both positive and negative affective states, are particularly important for self-efficacy related to physical activity. These findings therefore diverged from the established hierarchy posited in the extant literature. Further research is necessary to investigate how this hierarchy manifests in intervention studies. Finally, the fifth research project consisted of a latent profile analysis to demonstrate the existence of multiple advantageous profiles of self-efficacy sources (Publication 5). Consequently, subsequent studies that focus on enhancing self-efficacy and, thereby, indirectly increasing physical activity may also benefit from this person-centered approach.

A clear directive for future research emerges from a synthesis of the results of these five studies: Social Cognitive Theory provides a powerful conceptual foundation for designing effective physical activity interventions. Given the consistent finding that self-efficacy is a central determinant of physical activity, future work should specifically investigate and target its sources through innovative, person-centered intervention designs.

Zusammenfassung

In den letzten Jahren ist das Problem des Bewegungsmangels immer gravierender geworden. Die Weltgesundheitsorganisation sieht darin neben einem Bedarf nach strukturellen Veränderungen auf politischer und gesellschaftlicher Ebene auch einen Bedarf nach Verhaltensänderungen auf individueller Ebene. Um eine entsprechende Verhaltensänderung zu erreichen, ist es wichtig, die theoretischen Grundlagen des Verhaltens zu verstehen. Ein Beispiel ist die sehr prominente Sozial Kognitive Theorie von Albert Bandura, die zur Erklärung des Bewegungsverhaltens herangezogen werden kann. Sie geht davon aus, dass sowohl soziale Faktoren, wie etwa das gesellschaftliche Umfeld, der Wohnort sowie die Sicherheit von Straßen, als auch kognitive Faktoren, wie die Selbstwirksamkeit (die Überzeugung, theoretisch zu einem gewissen Verhalten in der Lage zu sein), die Ergebniserwartungen (die antizipierten positiven und negativen Konsequenzen eines Verhaltens) sowie die Zielsetzung in Bezug auf das Bewegungsverhalten, zusammenwirken.

Während die Sozial Kognitive Theorie in multiplen Domänen des Gesundheitsverhaltens häufig eingesetzt wird, ist ein Kritikpunkt, dass ein holistischer Modelltest fehlt. Denn obgleich die Theorie häufig zum Einsatz kommt, wird sie kaum in Gänze untersucht, sondern meist nur ausschnitthaft. Entsprechend war es ein Forschungsziel im Rahmen dieser Dissertation, einen entsprechenden holistischen Modelltest der Sozial Kognitiven Theorie in Bezug auf das Bewegungsverhalten durchzuführen und die Haltbarkeit der theoretischen Annahmen zu prüfen.

Das zweite Ziel der Forschungsarbeit im Rahmen dieser Dissertation war es, ein besseres Verständnis für die Entstehung von Selbstwirksamkeitsüberzeugungen zu erlangen. In der Sozial Kognitiven Theorie spielt die Selbstwirksamkeit insofern eine besondere Rolle, als dass sie das Verhalten sowohl direkt als auch indirekt beeinflusst: Sie nimmt Einfluss auf die Ergebniserwartungen, die soziostrukturellen Faktoren und die Zielsetzung, die ihrerseits das Verhalten beeinflussen. Aufgrund dieser prominenten Rolle hat sich die Forschung bisher intensiv mit den Effekten von Selbstwirksamkeit beschäftigt. Deutlich weniger ist allerdings darüber bekannt, wie diese Selbstwirksamkeitsüberzeugungen entstehen. Im Rahmen der Sozial Kognitiven Theorie postulierte Bandura vier Quellen der Selbstwirksamkeit: eigene Erfahrungen, stellvertretende Erfahrungen, Persuasion und affektive Zustände. Gemeinhin wird eine Hierarchie dieser Quellen angenommen, wobei nicht alle gleich relevant sind. Eine empirische Überprüfung dieser Hierarchie der Quellen der Selbstwirksamkeit gibt es bisher

allerdings nicht, sodass nicht klar ist, ob eine solche Hierarchie in der Relevanz der Quellen der Selbstwirksamkeit besteht und wie diese aussieht. Zudem wurden die Quellen der Selbstwirksamkeit bisher vorrangig singulär betrachtet, obwohl einige Forschungsbefunde für eine wechselseitige Beeinflussung der Quellen sprechen. Entsprechend ist unklar, ob systematische Unterschiede in den Ausprägungen der Quellen der Selbstwirksamkeit über die Personen hinweg bestehen, die möglicherweise als Grundlage für Interventionen auf Basis der Quellen der Selbstwirksamkeit dienen könnten.

Zur Beantwortung dieser zwei übergeordneten Forschungsfragen wurden insgesamt fünf Forschungsarbeiten durchgeführt. Zunächst wurde im Rahmen von Publikation 1 eine Skala mit insgesamt 18 Items entwickelt, die die gemeinsame Erfassung von Selbstwirksamkeit, Ergebniserwartungen, soziostrukturellen Faktoren und Zielen in Bezug auf das allgemeine Bewegungsverhalten erlaubt. Die Entwicklung und Validierung dieser Skala war insofern von besonderer Relevanz, da Überblicksarbeiten über vorherige Forschung unter Einsatz der Sozial Kognitiven Theorie meist auf die Schwäche hinweisen, dass eben keine validierten Fragebögen eingesetzt wurden. Hinsichtlich der Forschungsfrage nach der Haltbarkeit der theoretischen Annahmen der Sozial Kognitiven Theorie wurde daher die Optimierung der Erfassung der Konstrukte als wesentlicher Aspekt identifiziert.

Auf Basis der neu entwickelten Skala wurde anschließend im Rahmen von Publikation 2 mit einem Strukturgleichungsmodell überprüft, ob die theoretischen Annahmen der Sozial Kognitiven Theorie haltbar sind. Im Rahmen von Publikation 3 wurde die Haltbarkeit der theoretischen Annahmen erneut nachgewiesen, auch für Männer und Frauen separat. Während sich kleine Unterschiede in den Wirkweisen der einzelnen Komponenten der Sozial Kognitiven Theorie zeigten, konnte somit insgesamt die Haltbarkeit der theoretischen Annahmen der Sozial Kognitiven Theorie bestätigt werden.

In Bezug auf die Quellen der Selbstwirksamkeit wurde im Rahmen von Publikation 4 untersucht, welche Quellen der Selbstwirksamkeit von größerer Relevanz als andere sind. Die relative Wichtigkeitsanalyse zeigte, dass insbesondere eigene Erfahrungen, aber auch Selbstpersuasion und positive sowie negative affektive Zustände für die bewegungsbezogene Selbstwirksamkeit besonders relevant zu sein scheinen. Entsprechend wichen die Ergebnisse von der in der Literatur postulierten Hierarchie ab und zukünftige Forschung wird benötigt, um zu prüfen, wie die Hierarchie der Quellen der Selbstwirksamkeit sich im Rahmen von Interventionsstudien darstellt. Im Rahmen von Publikation 5 konnte mittels latenter

Profilanalyse gezeigt werden, dass es mehrere vorteilhafte Profile von Quellen der Selbstwirksamkeit gibt. Infolgedessen könnten zukünftige Studien, die darauf abzielen, die Selbstwirksamkeit und damit indirekt das Bewegungsverhalten zu steigern, auch von einem personenzentrierten Ansatz profitieren.

Insgesamt sprechen die Ergebnisse dafür, dass die Sozial Kognitive Theorie eine fundierte Grundlage für zukünftige Interventionen zur Steigerung des Bewegungsverhaltens bietet. Von besonderer Relevanz scheint dabei die Selbstwirksamkeit zu sein, weshalb zukünftige Forschung neben Interventionen basierend auf der gesamten Sozial Kognitiven Theorie auch spezifisch an den Quellen der Selbstwirksamkeit ansetzen könnte, einerseits an denjenigen Quellen, die sich als wichtig dargestellt haben, andererseits potenziell aber auch personenzentriert.

Auf Basis der Erkenntnisse der fünf Studien lassen sich demnach wichtige Schlussfolgerungen ziehen, auf denen die zukünftige Forschung zur Reduktion des Bewegungsmangels aufbauen könnte.

1 General Introduction

The global prevalence of noncommunicable diseases (NCDs) has increased significantly in recent years (e.g., Murray et al., 2012; Wagner & Brath, 2012) and is projected to continue growing and potentially accelerate in the future (Institute for Health Metrics and Evaluation, 2024). NCDs are a range of chronic illnesses resulting from a combination of genetic, physiological, environmental, and behavioral factors. They comprise the following four principal categories: cardiovascular diseases (e.g., myocardial infarction and stroke); cancers; chronic respiratory diseases (e.g., chronic obstructive pulmonary disease and asthma); and diabetes. These diseases currently cause 43 million deaths per year, representing 75% of all deaths worldwide. Cardiovascular diseases are responsible for the majority of these deaths, at 19 million individuals annually, followed by cancers (10 million), chronic respiratory diseases (4 million), and diabetes (2 million) (World Health Organization [WHO], 2024b).

The treatment of NCDs is limited to medications that target their metabolic risk factors, including high blood pressure, increased blood glucose, elevated blood lipids, and obesity. However, in addition to metabolic risk factors, these diseases are linked to the prevalence of lifestyle-related conditions in developed nations, which are caused by habits such as insufficient exercise, prolonged periods of sitting, excess consumption of processed foods, and high stress levels. Behavioral risk factors therefore exert a direct and indirect influence on the development of lifestyle diseases by promoting metabolic risk factors. For example, research has shown that modifiable behaviors, including tobacco use, physical inactivity, unhealthy diet, and harmful alcohol use, contribute to an elevated risk of NCDs (WHO, 2024b).

Consequently, considering behavioral risk factors in the context of NCD management is imperative (Michie et al., 2014; WHO, 2024b). Goal 3.4 of the United Nations' (UN) 2030 Agenda for Sustainable Development aims to: "By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being" (UN, 2015, p. 16). Accordingly, the World Health Organization (WHO) devised action plans to address specific behavioral risk factors, including physical inactivity and overeating, as part of an initiative designed to mitigate the prevalence of NCDs by promoting a healthier lifestyle with a focus on behavior change (WHO, 2018). This dissertation aims to contribute to this overarching focus on behavior change by deepening and broadening the extant knowledge base concerning the psychological foundations of behaviors that influence health, which is essential for informing subsequent behavior change.

This dissertation's first objective is to subject Social Cognitive Theory (SCT; Bandura, 1986), one of the most prominent theories for explaining and predicting behavior, to a holistic model test to examine the validity of its theoretical assumptions, using physical activity as an example of health behaviors. This will provide evidence regarding the utility and adequacy of SCT for understanding and modifying health behavior. To achieve this, the first step involved developing a questionnaire to assess the elements of SCT in the context of physical activity. Subsequently, two studies were conducted to investigate the validity of SCT's theoretical assumptions, one focusing on the overall validity of the assumptions and the other replicating and contributing to the knowledge base by examining their validity for men and women separately.

The second objective is to gain a more precise understanding of the genesis of self-efficacy beliefs. Research has demonstrated that self-efficacy is one of the strongest predictors of various health behaviors, including physical activity (Williams & Rhodes, 2016). A more nuanced understanding of the underlying sources of these beliefs could facilitate the design of systematic interventions to influence self-efficacy, which could, in turn, be reflected in the desired behavioral changes. Therefore, the present research delves into the intricacies of the formation of self-efficacy beliefs, focusing on the underlying sources. This exploration encompasses two distinct approaches: a variable-centered and a person-centered perspective. Both studies thus contribute to a more nuanced understanding of the emergence of self-efficacy beliefs in relation to physical activity behavior, providing a foundation for further research.

The following section provides an overview of physical activity behavior in general, as well as its role in lifestyle diseases. Then, a theoretical perspective on physical activity behavior is presented, along with an examination of SCT, including its supporting evidence and the research gaps that have been identified in the context of physical activity. The overarching research questions of this work are then derived from these gaps and are linked to the studies included in the dissertation.

2 General Theoretical Background

2.1 The Impact of Physical Activity on Health

Physical activity has historically been considered a secondary risk factor for diseases, rather than as a primary determinant of health outcomes (Das & Horton, 2012). Only recently has research begun to investigate the immediate effects of physical activity on health, well-being, disease, and illness (Lee et al., 2012). A succinct overview of the pertinent research findings will be presented in the subsequent sections.

2.1.1 Defining Physical Activity Behavior

Physical activity is a complex, multifaceted concept that incorporates numerous intricate behaviors. To gain a nuanced understanding, it is essential to adopt a comprehensive perspective that encompasses its diverse elements, which are captured in the definition provided by the World Health Organization:

> WHO defines physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure. Physical activity refers to all movements, including during leisure time, for transport to get to and from places, or as a part of a person´s work. (WHO, 2024a, Overview)

This definition of physical activity includes planned activities such as walking, cycling, sports, and active forms of recreation, including, for example, dancing, yoga, and Tai Chi. It also incorporates exercise carried out at work and at home. Exercise and sport can be classified as specific subcategories of physical activity. Exercise is a planned, structured, and repetitive activity specifically designed to enhance or preserve physical fitness, performance, or health (WHO, 2020). The sports subcategory represents physically demanding activities that also require dexterity and hand–eye coordination (WHO, 2020). It can include elements of competition and can be practiced both alone and as a team (WHO, 2020). In addition to this hierarchy, there are five distinct types of physical activity. These are briefly outlined below based on the detailed analysis provided by Piercy et al. (2018).

Aerobic activity—also referred to as endurance or cardio activity—involves the larger muscles moving rhythmically for a sustained period of time. The physiological effects of aerobic activity include increased heart rate and a corresponding increase in the effort required for respiration. The three components of aerobic physical activity are intensity,

frequency, and duration. Intensity pertains to the degree of exertion or effort an individual expends during an activity. Moderate (equivalent to a brisk walk) and vigorous (equivalent to running or jogging) intensities are the most commonly studied. “Frequency” describes how often an individual engages in aerobic activity, and "duration" refers to the length of time they spend performing the activity during a single session.

Resistance training and weightlifting are examples of *muscle-strengthening activities*, which engage the muscles in working against an external force or weight. Such activities frequently entail the repeated lifting of relatively heavy objects, such as weights, with the goal of strengthening the musculature of various parts of the body. Muscle-strengthening activities may also entail using elastic bands or one’s own body weight as a form of resistance. Muscle-strengthening activity includes three components: intensity, frequency, and sets and repetitions. The term "intensity" refers to the amount of weight or force that is utilized in relation to the individual's capacity to lift. “Frequency" describes how often an individual engages in muscle-strengthening activities. “Sets and repetitions" refers to the number of times a person performs a specific muscle-strengthening activity, such as lifting a weight or performing a push-up. This is analogous to the duration of an aerobic activity.

Bone-strengthening activities—also referred to as "weight-bearing" or "weight-loading" activities—exert a force upon the bones that has been demonstrated to stimulate bone growth and enhance bone strength. This force is typically generated by impact with the ground. Bone-strengthening activities may also be classified as either aerobic or muscle-strengthening.

Balance activities are exercises that enhance the capacity to withstand internal or external forces exerted on the body that could potentially cause a fall, whether the individual is stationary or in motion. The strengthening of muscles in the back, abdomen, and legs has also been demonstrated to improve balance.

Multicomponent physical activity programs comprise a combination of the above types of physical activity or training in gait, coordination, and physical function. Activities such as dancing, yoga, tai chi, gardening, and sports may also be considered multicomponent, given that they frequently involve a combination of diverse types of physical activities.

The relevance of different forms of physical activity may vary depending on social group or gender, as well as life stage (WHO, 2016). According to the WHO (WHO, 2024), all of these

forms may be considered under the umbrella term "physical activity," with each type potentially contributing to health benefits.

2.1.2 Impact of Physical Activity on Health

Numerous meta-analyses and reviews have substantiated the relationship between physical activity and health (e.g., Rahmati et al., 2025), and regular physical activity is recognized as one of the most significant determinants of both physical and mental health (OECD & World Health Organization, 2023). Perspectives on this relationship differ, however, with some research conceptualizing it from a deficit-oriented perspective, accentuating the adverse health consequences of physical inactivity (Warburton & Bredin, 2019). Corresponding messaging includes information that physical inactivity is responsible for between 6% and 10% of all deaths from NCDs, equivalent to 5.3 million deaths annually (Lee et al., 2012). There is minimal variation across studies regarding the precise number of deaths attributable to insufficient exercise, with Katzmarzyk et al. (2019) reporting that 7.2–7.6% of deaths from NCDs are caused by physical inactivity. However, there is a consensus that insufficient exercise constitutes a significant health risk, resulting in an annual mortality rate comparable to that of tobacco consumption (Katzmarzyk et al., 2019; Lee et al., 2012).

In contrast to the deficit-oriented perspective, an emerging body of research has adopted a novel framework by examining the relationship between physical activity and health from a strength-based perspective (Warburton & Bredin, 2019)., which emphasizes the positive effects and potential of physical activity (Warburton & Bredin, 2019, 2021). A comprehensive review of the extant literature on the physical health benefits of physical activity can, for example, be found in the work of Albini et al. (2025), Pedersen and Saltin (2015), Rhodes et al. (2017), and Warburton et al. (2006). A more in-depth analysis of the impact of physical activity on mental health can be found in the work of Mahindru et al. (2023) and Sabe et al. (2022). The following section presents a concise synopsis of the most salient findings.

Physical activity has been demonstrated to enhance physical health in several domains. It reduces the risk of developing cardiovascular disease (Kubota et al., 2017; Li & Siegrist, 2012) and improves the overall well-being of those with established cardiovascular diseases (Pinckard et al., 2019). Research also shows that regular physical activity plays a crucial role in reducing the risk of developing type 2 diabetes mellitus (Aune et al., 2015; Colberg et al., 2016;

Gill & Cooper, 2008; Jeon et al., 2007) and can be a highly effective strategy for managing a type 2 diabetes mellitus diagnosis (Seidu et al., 2021). Studies have also demonstrated that physical activity can reduce the risk of developing various types of cancer (Matthews et al., 2020; Moore et al., 2016; Thomson et al., 2014) and decrease the likelihood of cancer recurrence (Brown et al., 2023; Lahart et al., 2015). Furthermore, weight training in particular has been shown to have a positive impact on bone mineral density, thereby reducing the risk of osteoporosis and fractures (Pinheiro et al., 2020; Ponzano et al., 2021; Segev et al., 2018). In older adults, whose bone density has already declined, physical activity is an effective intervention for maintaining it and curtailing further loss (McMillan et al., 2017; Zhao et al., 2022).

Research has also confirmed the numerous positive impacts of physical activity on mental health across the lifespan (Teychenne et al., 2020), for example, by mitigating the symptoms of depression (Harvey et al., 2018; Kandola et al., 2019) and anxiety (Kandola et al., 2018; McDowell et al., 2019), underscoring its potential as a preventive and therapeutic intervention (Singh et al., 2023). Regular physical activity has also been shown to act as a protective factor during stressful life situations, contributing to resilience (Toth et al., 2023). Recent findings in the field of sports psychology have demonstrated that increased physical activity levels contribute to a sense of purpose and value, a better quality of life, and strengthened relationships and social connectedness (Das & Horton, 2012).

A substantial body of research has been conducted on the relationships between sufficient physical activity and numerous health benefits (Warburton & Bredin, 2016; Warburton & Bredin, 2017), indicating a curvilinear dose–response association between physical activity volume and specific health outcomes, including all-cause and cardiovascular disease mortality, as well as incident cancer and diabetes (Miles, 2007; Warburton & Bredin, 2016; Warburton & Bredin, 2017). The benefits are particularly evident at low levels of physical activity, supporting the assertion that any exertion is preferable to none. Even slight increases in physical activity can yield substantial health benefits for individuals who are typically inactive (Warburton & Bredin, 2016). For example, Wen et al. (2011) observed a 4% decrease in all-cause mortality and a 1% decrease in all-cancer mortality for each 15-minute increment of daily physical activity beyond the minimal requirement of 15 minutes.

Evidence suggests that increased engagement in physical activity confers greater benefits. However, the relative gains tend to diminish at higher levels of activity (Warburton

& Bredin, 2016). Although the precise point at which diminishing returns commence is unclear, the risks associated with excessive physical activity can be determined (Gottschall et al., 2020; Warburton et al., 2016). Excessive physical activity has deleterious short-term consequences, including cardiovascular events such as myocardial infarction. There may also be long-term health implications, manifesting as conditions such as excessive exercise (i.e., obsessive preoccupation with physical activity), body dysmorphic disorder (i.e., a clinical distortion of one's body image), and overtraining syndrome (i.e., sleep disturbances, weight and appetite loss, reduced libido, irritability, heavy and painful muscles, emotional lability, and depression) (Miles, 2007; Peluso & Andrade, 2005; Warburton et al., 2016).

However, the ceiling level of physical activity above which there are no additional health benefits or even increased health risks is relatively irrelevant for the general population (Warburton et al., 2016), whose primary concerns are the potential health benefits of moderate physical activity. Consequently, a series of recommendations has been formulated for the general population to help them mitigate the health risks associated with insufficient physical activity and facilitate the attainment of the health benefits associated with sufficient physical activity.

2.1.3 Physical Activity Guidelines

Established guidelines at both the national and international levels provide recommendations for the amount and type of physical activity individuals should engage in (Bull et al., 2020), based on the empirical findings regarding the health benefits of physical activity (Chaput et al., 2020). Comparing national recommendations for physical activity across different countries reveals significant parallels (Kahlmeier et al., 2015), which is because they are all predicated on the international guidelines (Kahlmeier et al., 2015; Rütten & Pfeifer, 2017). These recommendations target the general healthy population (Hämäläinen et al., 2020), with separate guidelines for specific groups, including children and adolescents, adults, and older adults. Additional guidelines have recently been developed for other unique groups, such as pregnant and postpartum women (Bull et al., 2020; Ding et al., 2020).

Physical activity recommendations undergo periodic revisions to ensure they are current and relevant (Ding et al., 2020). The most recent international guidelines, superseding the 2010 iteration, were published by the World Health Organization in 2020 (Bull et al., 2020), and provide guidance for children and adolescents, adults, older people, and pregnant and

postpartum women (Bull et al., 2020). They recommend that adults engage in regular physical activity, emphasizing the claim that some degree of physical activity is preferable to none. The adult guidelines for individuals aged 18–64 advise 150–300 minutes of moderate-intensity or 75–150 minutes of vigorous-intensity physical activity per week, or an equivalent combination of moderate-to-vigorous physical activity (MVPA). Additionally, they advocate for participation in muscle-strengthening activities at a moderate or greater intensity two or more days per week (Bull et al., 2020).

Although the latest recommendations are fundamentally consistent with the 2010 version (WHO, 2010) and largely compatible with even older recommendations (Ding et al., 2020), they introduce two key modifications. The first change is the inclusion of a recommended weekly target range for aerobic activity. The previous guidelines were open-ended, suggesting only a minimum threshold, predicated on the assumption that increased physical activity is beneficial to the general population (Bull et al., 2020; WHO, 2010). However, in light of the recent research findings demonstrating the potential health benefits associated with even low levels of physical activity, a target range was incorporated into the revision to replace the recommendation of a weekly minimum (Bull et al., 2020). The second change is the recommendation of bouts of MVPA of any duration, reflecting new evidence that supports the value of total physical activity volume regardless of how much time is spent exercising (Jakicic et al., 2019)—the previous WHO 2010 guidelines had suggested bouts of at least 10 minutes (Ding et al., 2020). In view of this adaptation, some authors have proposed a radical simplification of the existing physical activity recommendations; for example, the current US physical activity recommendations include the straightforward directive to "move more, sit less." (Piercy et al., 2018, p. 2025)

2.1.4 Prevalence and Global Burden of Physical Inactivity

Although health benefits may be attained with levels of physical activity below the recommended amounts (Warburton et al., 2016), international guidelines continue to serve as a benchmark for classifying individuals as active or inactive (WHO, 2022). The WHO currently estimates that approximately 30% of the global adult population can be classified as physically inactive, with estimates ranging from 27.5% (Guthold et al., 2018) to 31.3% (Strain et al., 2024). In 2016, 35.4% of European Union (EU) adults were classified as physically inactive, a figure higher than the global average, despite applying the WHO's international

standards for comparing physical activity across countries (Organisation for Economic Co-operation and Development [OECD] & WHO, 2023). These findings reflect a “worldwide activity inequality” (Althoff et al., 2017, p. 336), with some Western countries being particularly inactive (Guthold et al., 2018). However, the prevalence of inactivity exhibits consistent effects at both national and international levels related to age and gender. A global trend observed across all regions is that individuals tend to engage in less physical activity with age, and the incidence of physical inactivity increases after the age of 60, affecting both men and women (Strain et al., 2024).

Other than in East and Southeast Asia, where the prevalence of physical inactivity was 26.9% for men and 22.2% for women in 2022 (Strain et al., 2024), women exhibit a higher proportion of physical inactivity than men worldwide. The most recent estimates indicate that 33.8% of women and 28.7% of men are physically inactive internationally (Strain et al., 2024). Guthold et al.’s (2018) meta-analysis yielded comparable findings, with prevalence rates of 23.4% for men and 31.7% for women. The minor discrepancies between the estimates derived from the research by Strain et al. and Guthold et al. can be attributed to the fact that the former (Strain et al., 2024) considered a larger number of studies (507 population-based surveys comprising 5.7 million participants) than the latter (Guthold et al., 2018), who included 358 population-based surveys with 1.9 million participants. It may therefore be inferred that Strain et al.'s (2024) data reflect contemporary global patterns more accurately than those of Guthold et al. (2018). However, as both reviews report comparable findings and trends, they appear to corroborate one another.

Given the national and international initiatives to increase physical activity, it might be reasonable to expect a decline in the prevalence of physical inactivity over recent years. However, the data suggests the opposite. Strain et al. (2024) reported that inactivity increased from 23.4% to 31% between 2000 and 2022, with the number of physically inactive individuals growing from 900 million to 1.8 billion during that period. This upward trajectory is inconsistent with the WHO's objective of reducing physical inactivity on a global scale.

Several researchers have posited that physical inactivity is one of the most significant public health problems of the 21st century (Steene-Johannessen et al., 2016; WHO, 2009), suggesting that it is imperative to obtain a more profound understanding of physical activity behavior and its underlying factors (Althoff et al., 2017). There is an urgent need to enhance research on physical activity behavior, with the ultimate objective of developing future

interventions to halt or reverse this alarming trend of physical inactivity (Guthold et al., 2018; Strain et al., 2024).

2.1.5 A Theoretical Perspective on Physical Activity Behavior

Theories attempt to elucidate the mechanisms underlying a given behavior, to predict when and how such a behavior or behavior change may occur. They also seek to identify the key sources of influence that can be targeted to alter the behavior (Michie et al., 2014). Health behavior is the subject of a plethora of theories. For example, a comprehensive review conducted by Michie and colleagues (2014) identified upwards of 80 distinct theories purporting to elucidate the etiology and instigation of behavior. The majority of these frameworks focus on a specific subset of relevant constructs, with considerable overlap between the elements of different theories (West et al., 2019). Any theory employed at a specific moment regarding a particular behavior is subject to variation and is contingent upon the perspective from which the behavior is observed (Rhodes et al., 2019).

The majority of theories that are frequently employed to predict or explain health-related behaviors prioritize beliefs over emotions or habits, representing a key characteristic of "social-cognitive" approaches. These theories are based on the assumption that behavior is driven by underlying motives that are shaped by an individual's values and expectations. They adopt an agentic view (Bandura, 2001), regarding individuals as the primary conscious decision-makers and drivers of their own behavior. Conner and Norman (2009) conducted a meticulous examination of several social-cognitive theories, noting that despite differences across theories in the names of their elements, their content overlaps substantially. Bandura (1998, 2004) provides an illustration of these intersections.

Painter et al.'s (2008) comprehensive review of how theories on health behavior have been utilized in a sample of research published between 2000 and 2005 showed that the most frequently used approaches were the Transtheoretical Model (Prochaska & DiClemente, 1983) SCT (Bandura, 1986), and the Health Belief Model (Rosenstock, 1966), which are all categorized as social cognitive theories (Conner & Norman, 2009). The prominence of these theories was again confirmed by West and colleagues (2019), and a synthesis of the literature indicates that the social cognitive framework remains the dominant approach to psychological research (Rhodes et al., 2019). In the context of physical activity, Plotnikoff et al.'s (2013) meta-analysis verifies that social cognitive theories explain a significant amount of the

variance in both the intention to be physically active and the actual physical activity behavior. A meta-analysis revealed that the SCT and the Transtheoretical Model were the two most frequently utilized theoretical frameworks in research on physical activity (Prestwich et al., 2014). Despite both theories being classified as social-cognitive approaches, they have distinct foci. The Transtheoretical Model emphasizes how behavior change occurs and the stages through which it manifests (Conner & Norman, 2009; Prochaska & DiClemente, 1983). Conversely, the SCT focuses on identifying the internal and external factors that determine behavior (Conner & Norman, 2009; Maibach & Cotton, 1995). Therefore, the present research prioritizes an examination of physical activity from the perspective of SCT, focusing on understanding physical activity behavior rather than behavior change on a conceptual level.

2.2 Social Cognitive Theory

SCT (Bandura, 1986) posits that individuals are not merely passive bystanders to their preordained circumstances, a common view of human behavior in theological conceptions and during the eras of Darwinism and Behaviorism. Instead, SCT takes an agentic perspective on human behavior, suggesting that individuals can consciously influence their own behavior and environment, proactively shaping their situation through purposeful self-regulation and cognitive processes (Bandura, 2023). However, recognizing the relevance of determinism, Bandura embedded his SCT within the framework of triadic reciprocal determinism, which postulates that behavior, personal factors (such as cognition), and the environment are reciprocally related and can influence one another (Bandura, 2023).

Prior to the development of SCT, Bandura had introduced the theory of social learning in 1977, already emphasizing the significance of social modeling in the context of motivation, thought processes, and behavior. He first published the comprehensive version of his SCT in the 1986 book *Social Foundations of Thought and Action: A Social Cognitive Theory*. In 1997, he published *Self-efficacy: The exercise of control*, a seminal book that elucidated the pivotal role of cognition in shaping human behavior, while underscoring the significance of social influences.

In essence, Bandura's SCT clarifies the relations between cognition, environmental factors, and behavior (Bandura, 1986, 2000; Schwarzer, 2008). The key constructs of his theory therefore include cognitive variables, such as self-efficacy, outcome expectations, and goals. He also emphasizes the importance of socio-structural factors, including environmental

barriers and support in initiating, maintaining, and changing behavior (Luszczynska & Schwarzer, 2015).

This dissertation first presents the constructs as conceptualized by Bandura, before providing an in-depth analysis of the assumed relations among them and an evaluation of the empirical evidence that supports the theory and its assumptions.

2.2.1 Self-Efficacy

Self-efficacy is the first component of SCT and is often considered the most important. Bandura defines self-efficacy as follows: “Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave.” (Bandura, 1994, p. 71). Bandura offered similar definitions in both earlier and later works: “Perceived self-efficacy refers to beliefs in one´s capabilities to organize and execute the courses of action required to produce given levels of attainments” (Bandura, 1998, p. 624), and “perceived self-efficacy is not a measure of the skills one has but a belief about what one can do under different sets of conditions with whatever skills one possesses” (Bandura, 1982, p. 37). Bandura clarifies that

> (…) the basic phenomenon being addressed centers on people´s sense of personal efficacy to produce and to regulate events in their lives. Efficacy in dealing with one´s environment is not a fixed act or simply a matter of knowing what to do. Rather, it involves a generative capability in which component cognitive, social, and behavioral skills must be organized into integrated courses of action to serve innumerable purposes. (Bandura, 1982, p. 122)

In this sense, self-efficacy contributes to performance, regardless of an individual’s underlying skills (Bandura, 1995), but is not sufficient for behavior: “Effective functioning requires both skills and the efficacy beliefs to use them well” (Bandura, 1997, p. 37). Contrary to the assumption that self-efficacy beliefs are inert predictors of future behavior, Bandura posits that they influence thoughts, persistence, and motivation, which in turn impact performance (Bandura, 1997). Self-efficacy, defined as a perceived capability to perform some action, must be clearly distinguished from the intention to perform said action. Perceived self-efficacy can be viewed as a determinant of intention, but these constructs are conceptually and empirically distinct (Ajzen, 2002; Ajzen & Madden, 1986; Bandura, 2006; Devries &

Backbier, 1994; Dzewaltowski et al., 1990). Self-efficacy beliefs influence performance both directly and indirectly via goals (Bandura, 1997).

Self-efficacy differs from the similar but distinct constructs of self-esteem, locus of control, self-regulation, and outcome expectations. Self-efficacy represents a judgment of capability, whereas self-esteem is a judgment of self-worth (Bandura, 1997). Locus of control refers to the contingency of outcomes, and whether they are caused by forces beyond one´s control or by one´s actions (Ajzen, 2002; Bandura, 1997). Self-regulation is also distinct from self-efficacy, and is defined as: "(…) self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals." (Zimmerman, 2000, p. 14). It thus encompasses the selection of strategies and goals before initiating a given behavior, as well as ongoing reflections on the attainment of those goals during and after the behavior. Some authors suggest that self-efficacy is a precursor to self-regulation (Toharudin et al., 2019; Zou et al., 2023). However, Zimmerman (2000) integrates self-efficacy within his cyclical model of self-regulation, which proposes that self-regulation can be illustrated by three sequential phases with a cyclical interdependence: forethought, performance and volitional control, and self-reflection. *Forethought* is conceptualized as a pre-actional phase and includes task analysis and self-motivation, which incorporates self-efficacy, along with outcome expectations, intrinsic motivation, and goal orientation. Zimmerman assumes that this planning phase leads to *performance and volitional control*, the action phase, in which self-control and self-observation are important processes. Following this is *self-reflection*, the phase in which self-assessment and self-reaction occur. The achievement of a goal has been demonstrated to impact the subsequent planning phase, illustrating the cyclical process (Bandura, 1997, 2001; Schunk & Zimmerman, 2011; Zimmerman, 2000). Schunk and DiBenedetto (2020) conclude: "In a sense, motivational processes [like self-efficacy] set the stage for goal attainment but self-regulation takes over to help one reach goals." (p. 5). Finally, self-efficacy must be differentiated from outcome expectations, that is, judgments about the outcomes that are likely to result from a particular behavior and performance (Bandura, 2006).

Self-efficacy beliefs are generally thought to differ in terms of level, strength, and generality (Bandura, 1977, 1997). Level refers to the perceived difficulty of task performance. Self-efficacy beliefs are evaluated against this level of task demands, which are classified from low to high. The strength of efficacy beliefs refers to the level of perseverance in completing

a task despite challenges, with strong efficacy beliefs resulting in greater perseverance and weak beliefs indicating an individual's pre-emptive acceptance of defeat. The generality of self-efficacy also varies, differing across activities or situations. Individuals diverge in their self-efficacy judgments across different activities or situational variations (Bandura, 1997; Schwarzer & Jerusalem, 1995). Therefore, self-efficacy cannot be regarded as a trait. There is ample evidence that high self-efficacy beliefs in one domain are not necessarily associated with higher self-efficacy beliefs in other domains (DiClemente, 1986; Hofstetter et al., 1990). Instead, differentiated sets of self-efficacy beliefs relate to distinct domains of an individual´s behavior.

Bandura also offers insights into the genesis of self-efficacy beliefs. He delineates four sources, postulating that they differ in the strength of their influence on the development of perceived self-efficacy (Bandura, 1986). In this context, Bandura proposes that one's own experience—*mastery experience*—exerts the most significant influence on the genesis of self-efficacy (Bandura, 1997; Warner et al., 2011), suggesting that self-efficacy beliefs are most strengthened when success is not only experienced but also attributed to oneself and one's own skills (Schwarzer & Jerusalem, 2002). In principle, the internal attribution of success is thus considered the factor with the strongest influence on an individual's beliefs regarding their abilities when confronted with the same tasks in the future (Bandura, 1997; Warner et al., 2011). Therefore, in general, successes serve to strengthen self-efficacy, whereas failures, when attributed internally, weaken it (Schwarzer & Jerusalem, 2002). Bandura (1997) delineates additional sources of self-efficacy beliefs, including *vicarious experiences, verbal persuasion*, and *affective states*. He defines *vicarious experience* as observing another individual modeling the successful navigation of a challenging task (Bandura, 1977). Such observation results in the formation of conclusions about oneself and one's own abilities, suggesting that self-efficacy can be reinforced through a social comparison process (Schwarzer & Jerusalem, 2002). The efficacy of model learning is further enhanced when the model closely resembles the learner in terms of age, gender, or other characteristics (Bandura, 1986, 2000). Vicarious experience is considered a valuable secondary source for the development of self-efficacy beliefs, particularly in contexts where personal experience is constrained (Schwarzer & Jerusalem, 2002).

Verbal persuasion is defined as encouragement or persuasion by others. This dynamic entails an external party persuading the individual of their capabilities, verbally articulating

this perception. Consequently, the individual is motivated to act (Bandura, 1997). Warner et al. (2014) differentiate between *verbal persuasion by others* and *verbal self-persuasion*, categorizing them as either external or internal, respectively. The authors thus extend Bandura's concept, emphasizing that self-persuasion can also be a source of self-efficacy. Verbal persuasion by others is a source of self-efficacy beliefs primarily when persuasion attempts are made by someone who is of great significance to the listener or exudes a certain degree of authority (Bandura, 1997). However, these attempts at persuasion also entail the risk that the individual being persuaded will view them critically, resulting in precisely the opposite effect (Dholakia & Sternthal, 1977; Schwarzer & Jerusalem, 2002). Bandura (1997) posits that the *affective states* of the actor, which are contingent on the situation, represent the final source of self-efficacy. For instance, an individual may perceive an objectively risky situation as safe and, consequently, feel capable of successfully navigating it (Luszczynska & Schwarzer, 2015). Conversely, a high state of arousal may be experienced as a lack of competence, which, in turn, can prevent any action (Schwarzer & Jerusalem, 2002). Emotional arousal is generally defined as the weakest source of self-efficacy (Schwarzer & Jerusalem, 2002). Warner et al. (2014) suggested differentiating between positive and negative affective states as the individual sources of self-efficacy beliefs.

Previous studies have demonstrated correlations between these presumed sources and self-efficacy itself, and research also indicates that the promotion of these sources results in heightened self-efficacy (e.g., Aldenaini et al., 2020; Ashford et al., 2010; Galanis et al., 2016; Hardy et al., 2005; Kim et al., 2021; Parschau et al., 2013, 2014; Rowland et al., 2020; Selzler et al., 2020; Wiedenman et al., 2024). These studies thus confirm Bandura's assumptions concerning the sources of self-efficacy. However, the idea that these sources vary in importance remains to be empirically substantiated. Bandura's theoretical framework suggests that some sources of self-efficacy have a greater influence than others, and other authors have made similar propositions (e.g., Pajares, 1997; Schwarzer & Luszczynska, 2022). The prevailing consensus among scholars is that the mastery experiences are the most important source of self-efficacy, followed by vicarious experiences, persuasion, and affective states (Schwarzer & Luszczynska, 2022). However, there is a lack of research confirming this hierarchy of self-efficacy sources, and whether the sources actually differ in importance remains unclear.

2.2.2 Outcome expectations

Behavior is also affected by individuals' expectations about the outcomes produced by their actions. *Outcome expectations* are defined as an individual's beliefs regarding the possible consequences of a particular action (Luszczynska & Schwarzer, 2020). They are commonly understood to reflect the anticipation of a specific outcome that is contingent upon a particular behavior (Williams et al., 2005). Specifically, SCT posits that individuals are likely to engage in behaviors that they believe will lead to positive outcomes and avoid behaviors that they believe will result in negative outcomes (Williams et al., 2005). Self-efficacy, defined as one's perception of one's capability to act, is distinct from outcome expectations, which encompass the anticipated consequences of a behavior (Luszczynska & Schwarzer, 2020; Maibach & Murphy, 1995). Combined, these two constructs are regarded as the fundamental components of SCT for predicting behavior.

Bandura's original theory posited a unilateral influence of self-efficacy on outcome expectations (Bandura, 1986). However, subsequent research (summarized, for example, by Williams, 2010) has questioned this assumption by demonstrating that expected outcomes can indeed causally influence self-efficacy. Kirsch (1995) and Beauchamp et al. (2019) provided synopses of this contradiction, and proposed a conceptual differentiation that may facilitate a resolution. Regardless of the inconsistent findings on the influence of self-efficacy and outcome expectations, Bandura suggests that outcome expectancies have both a direct predictive effect on behavior and an indirect effect through goal setting. Consequently, he considers outcome expectations a pivotal influencing factor in the initial formation of goals. The personal evaluation of anticipated consequences dictates the development of intentions to pursue specific behavioral changes (Luszczynska & Schwarzer, 2015). Consequently, expectations about results can play a reinforcing role in behavior, with consequence anticipation representing a form of self-motivation (Armitage et al., 2015; Bandura, 2023).

Bandura (1986, 1998, 2006) made a conceptual distinction between physical, social, and self-evaluative outcome expectations. Both positive and negative ramifications are conceivable in each case, with positive expectations serving as incentives and the negative as disincentives (Bandura, 2006). *Physical outcome expectations*, as defined by Bandura (2006), refer to physical or health-related changes that are expected to result from a specific behavior, encompassing sensory impressions such as pain (Bandura, 1998) and material losses or gains (Bandura, 2004). According to Bandura (2004), *social outcome expectations* are the

anticipated reactions of other individuals or groups who are provoked by a specific behavior. Such reactions may encompass recognition, praise, affirmation, and acceptance, but also condemnation, rejection, or other negative forms of third-party response. Outcome expectations are also significantly influenced by personal standards and demands on oneself, which are referred to as *affective* or *self-evaluative outcome expectations* (Bandura, 2004). This category of outcome expectations encompasses the anticipated personal sentiments that follow an action, and Bandura (1998) considers it the most substantial regulatory outcome expectation.

2.2.3 Socio-Structural Factors

SCT posits that behavioral regulation is not solely a personal matter; the presence of facilitators and the absence of impediments, both social and structural, are of paramount significance. These factors shape physical activity behavior by either supporting or restricting participation, highlighting the need for an environment that promotes sustained engagement in physical activity. Bandura (1997) outlined the concept of *socio-structural factors*, which refer to the impediments (barriers) and opportunities that are embedded within living conditions and health, political, economic, or environmental systems. He clarifies:

> The regulation of behavior is not solely a personal matter. Some of the impediments to healthful living reside in health systems rather than in personal or situational impediments. Unavailability of health resources presents a second class of barriers to healthful behavior. These impediments are rooted in how health services are structured socially and economically. (Bandura, 1998, p. 629)

Some scholars (e.g., Beauchamp et al., 2019) have proposed that determining objective circumstances in the environment, as well as in health, political, and economic systems, is less decisive in this context, suggesting that the pivotal element instead lies in the subjective appraisal of these factors. This perspective posits that individuals may perceive and interpret their environment differently, even in the face of comparable living conditions. Consequently, the extent to which self-efficacy influences socio-structural factors becomes more evident.

2.2.4 Goals

Bandura (2004) defines goals as health-related objectives that individuals establish for themselves and the specific plans and strategies they implement to achieve them. They can

be understood as conscious aspirations that are actively pursued. Goals serve as a guiding framework for developing and maintaining healthy behavior. Prior research has demonstrated that a lack of commitment to a goal is associated with a lack of behavior that corresponds to achieving that goal (Locke & Latham, 2002). Once an initial commitment to achieving a goal has been made, the goal itself motivates the individual to behave in a manner consistent with the desired outcome. Goals assist in focusing attention on pertinent aspects of a task or behavior.

Goals are crucial motivational elements that vary along continuums of specificity, proximity, and difficulty (Bandura, 1999). Several research studies have demonstrated that specific goals, such as "jog 10 kilometers", with performance standards ("jog 10 kilometers in less than one hour"), are more likely to result in the desired behavior ("increased physical activity") than general goals, such as "go jogging." Most major theories agree that goals should be as specific as possible to facilitate action (Bandura, 1997; Fishbein & Ajzen, 1975; Gollwitzer, 1999) because they help to clearly define the task, facilitating self-regulation. Furthermore, ascertaining whether a goal has been achieved or not is easier if it is specific.

Proximal, short-term goals are assumed to be more motivating than distal, long-term goals, as procrastination behavior often hinders the achievement of the latter (Schunk, 2012). Proximal goals are short-term and intermediate, influencing current behavior and the effort invested (Luszczynska & Schwarzer, 2015). Conversely, distal goals offer a more general orientation, but are less effective at controlling current behavior due to competing influences (Bandura et al., 1999). Other social cognitive theories conceptualize intentions as being more similar to proximal than distal goals (Bandura, 1997).

Goals vary in terms of difficulty and the level of task proficiency required, which influences the amount of effort individuals expend. As demonstrated by Locke and Latham (2015), neither exceedingly difficult nor exceedingly easy goals serve as effective motivators. However, goals perceived as challenging yet attainable proved to be particularly motivating. Locke and Latham (2013) also demonstrated a linear relationship between goal difficulty and performance, indicating that individuals consistently exhibited superior performance when faced with challenging goals compared to those with less demanding objectives. Studies have consistently shown that establishing challenging personal goals enhances motivation across various behavioral domains, populations, and time spans (Bandura, 1986; Locke & Latham, 1990).

2.2.5 Key Tenets and Evidentiary Support

Figure 1 depicts a schematic representation of SCT as presented by Bandura in numerous publications (e.g., Bandura, 2004). The figure visualizes the causal direct and indirect modes of action of the constructs.

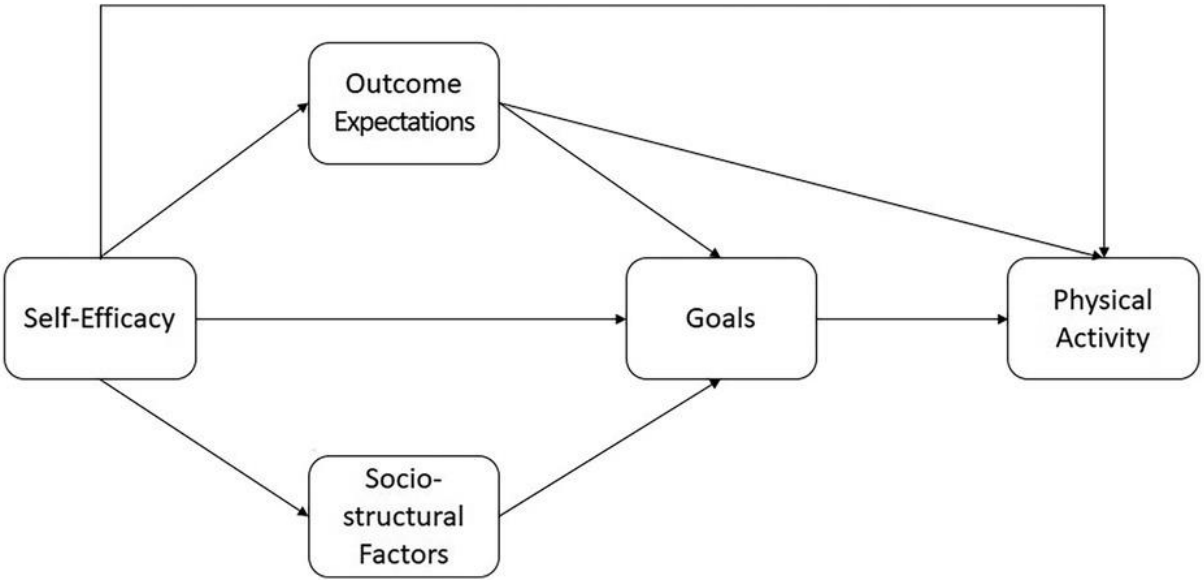

Figure 1. Schematic representation of Social Cognitive Theory adapted from Bandura (2004)

Bandura assumes that self-efficacy directly influences outcome expectations, socio-structural factors, goals, and behavior. Outcome expectations directly influence goals and behavior. Goals also directly affect behavior, whereas socio-structural factors only impact behavior indirectly through their influence on goals. SCT thus incorporates both the direct and indirect pathways through which cognitive and social factors influence behavior. Because the indirect effect of self-efficacy on behavior encompasses the other constructs as mediators, researchers often reduce SCT to focusing on the aspect of self-efficacy (Williams & Rhodes, 2016).

Empirical research has thoroughly documented the various components of SCT, both in terms of their relationship with behavior and the postulated effects they have on the other elements of the model. There is abundant research examining the bivariate correlations among the constructs; however, studies investigating causal direct effects are limited, and research on indirect effects is comparatively scarce.

The existing literature has extensively documented the impact of self-efficacy on physical activity behavior (De Bourdeaudhuij & Sallis, 2002; Lippke et al., 2004; Steca et al., 2024; Young et al., 2014). For example, Di Maio et al. (2021) and McAuley and Blissmer (2000)

found an association between higher self-efficacy and a greater likelihood of achieving physical activity recommendations. Malherbe et al. (2003) showed that self-efficacy predicts exercise adherence, and Oman and King (1998) demonstrated that self-efficacy beliefs significantly predict physical activity two years later.

In addition to its impact on behavior, self-efficacy is assumed to influence outcome expectations, socio-structural factors, and goals (Bandura, 1997). In the context of self-imposed goals, individuals with high self-efficacy tend to set more ambitious goals for themselves compared to those with lower self-efficacy (Locke & Latham, 1990, 2002; Seijts & Latham, 2001). Additionally, previous research has demonstrated an indirect effect of self-efficacy on physical activity through goal-setting (Dishman et al., 2019; Hall et al., 2010). While the impact of self-efficacy on goals is substantiated in the literature, its effect on outcome expectations is less clear. Most work suggests a bidirectional relationship rather than a causal effect (e.g., Williams & Rhodes, 2016). Similarly, the directionality of the relationship between socio-structural factors and self-efficacy is uncertain, but prior research indicates that the relationship might be bidirectional (e.g., Clark et al., 1995; Cook et al., 2015).

The impact of outcome expectations on goal setting and behavior is well documented (Bohlen et al., 2022; Choi et al., 2017; Young et al., 2014). Research shows that self-evaluative, physical, and social outcome expectations are significantly related to self-reported physical activity behavior (Bohlen et al., 2022; Petosa et al., 2005), with higher outcome expectations associated with greater participation in physical activity (Gothe, 2018; Wójcicki et al., 2009). Additionally, evidence suggests that interventions aimed at enhancing self-efficacy can increase outcome expectations related to physical activity, which in turn lead to greater engagement (Gothe, 2018), supporting the notion that outcome expectations mediate the relationship between self-efficacy and physical activity. These findings align with SCT, which posits that an individual's beliefs about the benefits and consequences of a behavior, which are shaped by self-efficacy, are critical in motivating action (Resnick et al., 2008).

A close examination of existing evidence regarding socio-structural factors reveals the multidimensionality of socio-structural factors once more. Neighborhood safety, walkability, access to public transportation, weather conditions, and topography can either facilitate physical activity or, if absent, represent substantial barriers (Fleig et al., 2016; Martín-Moya et al., 2020; Olanrewaju et al., 2016). Convenient scheduling and easily accessible venues are also crucial for encouraging participation (Olanrewaju et al., 2016). Studies have shown that

crime and poor accessibility of exercise facilities are significant barriers to the engagement of older adults in physical activity (Gothe & Kendall, 2016). The effect of social support on physical activity is unclear (Laird et al., 2016), although research often finds a correlation between the two (Bauman et al., 2012). Studies generally emphasize the complexity of socio-structural factors, which highlights the need for more in-depth research in this area.

Interestingly, recent research has challenged the prevailing assumption in SCT that socio-structural factors only influence behavior indirectly through goal setting (Bandura, 2004). Findings suggest that socio-structural factors may have a direct impact on behavior (Beauchamp et al., 2019). Indeed, studies have more frequently examined a direct effect of socio-structural factors on physical activity than an indirect effect (Young et al., 2014). Whether the effect is direct or indirect appears to depend on the different facets of socio-structural factors, with factors such as social support tending to have a direct effect and those such as socioeconomic status impacting behavior indirectly (Young et al., 2014). However, Young et al.'s (2014) meta-analysis, which collectively assessed socio-structural factors, revealed no consistent correlation with physical activity, neither directly nor indirectly, indicating the need for further research (Young et al., 2014).

According to SCT, goals constitute a primary source of motivation for behavioral change and maintenance (Bandura, 1986). Indeed, extant research demonstrates that intentions and goals are significant predictors of physical activity (Conner & Norman, 2022). For example, goals have been shown to predict both physical activity levels (Chase et al., 2018) and endurance (McCormick et al., 2015). Nevertheless, meta-analyses have provided evidence of substantial discrepancies between individuals' intentions and their actual behaviors (Conner & Norman, 2022; Feil et al., 2023). While these findings suggest that goals are a crucial predictor of physical activity, alone, they are insufficient to influence actual behavioral outcomes.

2.3 Research Gaps and Challenges of Applying SCT to Physical Activity

The constructs of SCT have been studied and validated to various extents, with a preponderance of the research on the theory dedicated to the domain of self-efficacy within its broader framework. Bandura and numerous other researchers have extensively investigated self-efficacy, with the aim of improving our understanding of the impact of self-efficacy on cognitive, social, and behavioral factors, as well as the relationships among them

(Choi et al., 2017; Hevey et al., 1998; Warner & Schwarzer, 2020). While there is evidence to support the other constructs of SCT, they have received significantly less research attention (Bandura, 2023; Beauchamp et al., 2019). This phenomenon has been documented and critiqued on multiple occasions within the literature, including in the work of Young et al. (2014), whose systematic review of SCT research in the context of physical activity found that "the majority of SCT research has focused solely upon self-efficacy or examined self-efficacy in combination with only one or two other variables" (p. 985). Bandura himself also criticized this approach of selectively testing and applying individual elements of SCT:

> Self-efficacy has received such attention that writers have sometimes appeared to conflate the study of self-efficacy beliefs with the entire social cognitive framework. This is a mistake. One must distinguish Social Cognitive Theory as a whole from its self-efficacy component. (Bandura, 2023, p. 55)

Despite Bandura's critique of the reduction of SCT to its self-efficacy component (Bandura, 1986, 2023; Luszczynska & Schwarzer, 2015), little has changed, and reviews on SCT consistently report that the theory is still rarely tested in its entirety (Beyera et al., 2022; McAlister et al., 2008). Young et al. (2014), for example, provide a comprehensive overview demonstrating the rarity of holistic model tests that incorporate every direct and indirect effect as postulated by Bandura (Bandura, 1986). Other authors have also criticized the lack of a holistic perspective within the SCT framework; for example, Beyera et al. (2022), McAlister et al. (2008), and Prestwich et al. (2015). The absence of a comprehensive model test poses a challenge for explaining and predicting behavior based on the tenets of SCT, given that the framework's underlying theoretical assumptions remain unvalidated. Therefore, a significant research gap has been identified regarding the implementation of SCT in the domain of physical activity behavior, which pertains to the validation of the theory's assumptions. This gap was highlighted by Young et al. (2016) in their research recommendations concerning SCT:

> To generate more valid data regarding the utility of SCT to explain PA, it is crucial that future studies include measures for all constructs in appropriately specified structural equation models and report the direct, indirect, and total effects of all variables. (Young et al., 2016, p. N184)

The present research endeavors to address this research gap and conduct a holistic model test that includes the direct, indirect, and total effects of all elements of SCT in the context of physical activity behavior. The implementation of a holistic model test offers two

distinct advantages. First, it provides an opportunity to evaluate the theoretical assumptions of the SCT framework, which is frequently utilized to explain and predict behavioral phenomena. A holistic model test can thus contribute to an evaluation of the theory´s practical value. Conversely, a review of the theoretical assumptions may provide insight into whether reducing SCT to its self-efficacy component is less problematic than initially assumed, particularly if evidence emerges to suggest that self-efficacy has a disproportionately high level of importance. Therefore, this dissertation's first research question relates to the validity of SCT's theoretical assumptions.

There is a notable lack of available scales with strong psychometric properties for a comprehensive assessment of the components of SCT. As noted by Young et al., "only 4% of the models measured all SCT constructs using scales with adequate internal consistency and test–retest reliability" (Young et al., 2014, p. 15). This is problematic, as the coverage and delineation of SCT's constructs, both individually and combined, may be ambiguous. Therefore, it is crucial to develop and validate a questionnaire for conducting new SCT research that aligns with the relevant criterion of general physical activity and can therefore address this dissertation's research questions.

The second research question pertains to the etiology of self-efficacy beliefs. Self-efficacy, the most extensively researched component of SCT, serves as a significant predictor of numerous health behaviors, including physical activity (Hevey et al., 1998; Holden, 1992). In some cases, self-efficacy is considered the foremost predictor of such behavior (Rovniak et al., 2002; Warner et al., 2011). Although the robust correlation between self-efficacy and behavior has been well-established, self-efficacy has primarily been evaluated as a fundamental starting point for explaining and changing cognitive and behavioral conditions and states (Ashford et al., 2010; Williams & French, 2011). Limited research has been conducted on the emergence of self-efficacy and the genesis of self-efficacy beliefs (Morris et al., 2017; Usher & Pajares, 2008). As outlined in Chapter 2.2.1, Bandura posited that self-efficacy beliefs stem from four distinct sources: mastery experience, vicarious experience, persuasion, and affective states (Bandura, 1986, 1997). It has been hypothesized that some of these sources may be more important than others (Bandura, 1977; Pajares, 1997; Schwarzer & Luszczynska, 2022). In the hierarchy of sources, mastery experiences are considered the strongest source of self-efficacy, and affective states are considered the weakest (Schwarzer & Luszczynska, 2022). Studies examining the factors that influence self-efficacy in the context

of physical activity have also demonstrated that Bandura's hypothesized sources of self-efficacy appear to be related to self-efficacy (Ashford et al., 2010; Williams & French, 2011). However, the hierarchy of sources and their relative importance has not yet been conclusively clarified. Given the foundational role of self-efficacy in numerous health behaviors and its prominent role in interventions for behavior change, it is essential to gain a more profound understanding of the relative importance of the sources of self-efficacy in order to foster it as efficiently as possible.

Surprisingly, the sources of self-efficacy have only been considered in isolation as individual, additive factors (Byars-Winston et al., 2017). A holistic perspective on the sources of self-efficacy therefore seems warranted, assuming that individuals possess a complex and unique configuration of experiences and influences that collectively shape their self-efficacy (Samson & Solmon, 2011). Therefore, examining the various ways in which different self-efficacy sources interact within individuals and exploring the systematic patterns that emerge in terms of interindividual differences in the expressions of the sources and their resulting self-efficacy may further enhance our understanding of the origins of self-efficacy.

A more profound comprehension of the etiology of self-efficacy is imperative in the context of potential interventions targeting self-efficacy and, by extension, physical activity. The employment of a *variable-centered* perspective, which explores the most important sources of self-efficacy, and a *person-centered* perspective, which examines patterns in these sources, may facilitate the development of more efficacious interventions. Such interventions could target the specific sources of self-efficacy that are of paramount importance. They may also be effective in addressing more than one source, informed by the respective patterns, resulting in customized and personalized support, tailored to each individual's unique needs and characteristics.

To summarize, the two overarching research questions guiding this dissertation are as follows:

1) Are the theoretical assumptions of Social Cognitive Theory valid in the context of physical activity behavior?
2) Do the sources of self-efficacy vary in importance, and are there differences in their individual configurations?

These research questions are addressed in a series of five publications:

Publication 1 focuses on the development of a questionnaire to assess the elements of SCT in the context of physical activity behavior. This preliminary work forms the foundation of

the subsequent publications, namely, Publication 2, which tests the validity of SCT's theoretical assumptions in the general population, and Publication 3, which examines the validity of SCT's theoretical assumptions, focusing specifically on men and women. Publications 4 and 5 are dedicated to the genesis of self-efficacy beliefs, with Publication 4 employing a variable-centered perspective to investigate the relative importance of the sources of self-efficacy and Publication 5 using a person-centered perspective to identify profiles of these sources.

This dissertation makes a significant contribution to the field by providing a more nuanced understanding of physical activity behavior through the lens of SCT. This is achieved by developing a novel instrument for assessing the theory, providing rigorous empirical tests of the theory's explanatory basis, and deepening our understanding of the sources of self-efficacy, a critical predictor of behavior.

3 Publication 1

Egele, V. S., & Stark, R. (2024). Operationalization of the social cognitive theory to explain and predict physical activity in Germany: A scale development. *Frontiers in Sports and Active Living*, *6*, 1508602. https://doi.org/10.3389/fspor.2024.1508602

4 Publication 2

Egele, V. S., Klopp, E., & Stark, R. (2025). How Valid Is Bandura's Social Cognitive Theory to Explain Physical Activity Behavior?. *European Journal of Investigation in Health, Psychology and Education*, *15*(2), 20. https://doi.org/10.3390/ejihpe15020020

5 Publication 3

Egele, V. S., & Stark, R. (2025). Social Cognitive Theory and Physical Activity: Examining Gender-Based Prediction Patterns and Theoretical Validity. *Sports*, *13*(8), 249. https://doi.org/10.3390/sports13080249

6 Publication 4

Egele, V. S., Klopp, E., & Stark, R. (2025). An Empirical Ranking of the Importance of the Sources of Self-Efficacy for Physical Activity. *Health Psychology and Behavioral Medicine*, *13*(1). https://doi.org/10.1080/21642850.2025.2567322

7 Publication 5

Egele, V. S., & Stark, R. (accepted). A latent profile analysis of the sources of physical activity-specific self-efficacy. Manuscript submitted for publication to *Health Psychology Open*.

8 General Discussion

This research was guided by two overarching aims, the first of which was to conduct a holistic model test of SCT's theoretical assumptions. This involved developing and validating a questionnaire to assess the elements of SCT, followed by an investigation of the validity of its theoretical assumptions in the context of physical activity behavior for both the general population and for men and women separately. The second aim was to gain a more in-depth understanding of the genesis of self-efficacy beliefs related to physical activity by investigating which sources of self-efficacy are most important and whether systematic inter-individual differences exist in how these sources are configured in the context of physical activity.

8.1 Critical Appraisal of Key Findings and Theoretical Implications

8.1.1 Findings Concerning the Validity of the Theoretical Assumptions of SCT

A central challenge identified in previous SCT research (Young et al., 2014) is that studies are often conducted without using scales that meet established quality criteria. To address this issue of theoretical validity and prepare for the subsequent studies addressing the research questions, a new questionnaire was developed. This questionnaire was designed to be parsimonious and easy to use with a healthy German population, and with the aim of assessing the elements of SCT in the context of general physical activity. The newly developed questionnaire comprises 18 items, with five items each pertaining to self-efficacy and outcome expectations, and four items each relating to socio-structural factors and goals. The questionnaire's psychometric properties were satisfactory in terms of both reliability and validity.

Despite the careful development of the questionnaire and its satisfactory psychometric properties, some limitations of the instrument must be noted. First, the questionnaire was brief, and it was therefore not feasible to comprehensively map all components of the SCT. Consequently, certain aspects of the elements may not have been included within the scope of the questionnaire, potentially leading to missed correlations or effects.

The implementation of a novel questionnaire for the operationalization of SCT constructs also gives rise to certain complications. Most researchers have assessed SCT using their own scales, designed and tailored to their specific research aims, in accordance with Bandura's (2006) recommendations (Luszczynska & Schwarzer, 2015). This approach has

yielded a diverse body of questionnaires, each with its own particularities that render them largely non-comparable, posing a challenge to comprehensive analysis and the synthesis of findings across studies. In the absence of a suitable questionnaire for the purposes of the present research, the best solution was to develop and validate a new questionnaire.

Finally, there are ambiguities regarding the construction of the scale. Bandura (2006) offers comprehensive recommendations for constructing self-efficacy scales in a dedicated book chapter. However, no such recommendations exist for constructing scales to assess outcome expectation, socio-structural factors, or goals. Bandura's suggestions were therefore adhered to meticulously in the process of creating the self-efficacy items. However, given the absence of similar guidelines for the other constructs, the optimal formulation of the respective items remains somewhat uncertain. These limitations are not inherent to the new questionnaire but affect all questionnaires that evaluate the SCT constructs, but they must be taken into account in the new questionnaire.

The new questionnaire´s primary advantage lies in its parsimony, making it suitable for low-cost investigations of SCT within the context of physical activity. Additionally, the newly developed questionnaire has strengths, including the fact that all social-cognitive factors are assessed conjointly and that it has established, satisfactory psychometric properties. These strengths are particularly relevant in light of the questionnaire's intended use—to elucidate the validity of the theoretical assumptions underlying SCT.

Publications 2 and 3 empirically evaluated SCT's underlying theoretical assumptions, producing findings that support the validity of the interplay among the theory's constituent elements. A relatively novel and seldom used method was selected for this evaluation, employing a statistical technique that considered the structural model independently of the measurement model (Lance et al., 2016). The prevailing standard of the structural equation modeling (SEM) procedure does not differentiate between these models, and the goodness-of-fit indexes simultaneously assess the fit of both the measurement model (which specifies the relationships between the latent variables and their observed indicators) and the structural model (which specifies the causal relationships between the latent variables), thereby precluding an independent evaluation of theoretical assumptions (Lance et al., 2016). Distinguishing between the structural model and the measurement model, however, enables substantiated insights into the theoretical validity of Bandura's assumptions regarding the relationships among SCT's constructs. Given that examining theoretical validity was the

primary aim, the fit of the structural model was of particular interest. Thus, Lance et al.'s (2016) recommendations were followed, and the structural model and the measurement model were each considered separately. This approach enabled the validation of the theoretical assumptions; it is therefore particularly significant that these assumptions were substantiated through an examination of the structural model alone.

The holistic model tests of SCT in Publications 2 and 3 revealed the tenability of Bandura's proposed pathways. However, a more thorough examination of the results of the two studies uncovered some ambiguities and inconsistencies. In Publication 2, the indirect pathways from self-efficacy to goals and behavior via socio-structural factors were not significant. Conversely, these indirect effects were significant in the overall sample in Publication 3. The sample size discrepancy between the two studies must be taken into account, as that in Publication 3 was approximately three times larger than that in Publication 2. The men-to-women ratio also differed slightly between the two samples, at approximately 56% in Publication 2 and 41% in Publication 3. The observed differences may therefore plausibly be attributed to differences in sample size. The findings of Publication 3 indicated that the gender ratio may also have had an impact, as the indirect effects of self-efficacy on goals and behavior via the socio-structural factors were significant for women, but not for men. Therefore, the effects of the socio-structural factors may need to be considered in a more nuanced way. For example, it could be hypothesized that some socio-structural factors are more salient for women than for men. Evidentiary support for this proposal is provided in the review by Tcymbal et al. (2020), which indicates that certain environmental factors have an equivalent influence on the exercise behavior of both men and women, but some factors have a greater effect on either gender (e.g., the availability of public transport increased physical activity more in women than in men). A deeper investigation is therefore warranted to address these issues.

No significant indirect effect of socio-structural factors on behavior was found in the overall sample of Publication 2 or in the male sample of Publication 3. This could be attributed to the conceptualization of socio-structural factors. As Bandura explained in his seminal construct definition (see Chapter 2.2.3), there exist a multitude of potential influencing factors. The brevity of the newly developed questionnaire (Publication 1) potentially complicates capturing the intricacies of the "socio-structural factors" construct. The items emphasize health restrictions and environmental conditions rather than social support, health

systems, socioeconomic status, and other related factors. Consequently, it can be hypothesized that the scale only exhibits partial coverage of the construct, which may result in missing statistically significant results for the causal relationships posited by Bandura. Nevertheless, these limitations are not without precedent. Research in the literature commonly only assesses certain selected socio-structural factors, and the effects of socio-structural factors are fairly frequently found to be insignificant (Young et al., 2014). A meta-analysis of the application of SCT to the field of physical activity found that, among the rare studies reporting an indirect effect of socio-structural factors on physical activity, this effect was only statistically significant in one third of them (Young et al., 2014) .

Young et al.'s (2014) meta-analysis also revealed that studies tend to examine the direct effects of socio-structural factors on physical activity behavior more frequently than they examine the indirect effect. It must be acknowledged that this does not imply that no indirect effect exists; however, the exploration of indirect effects remains limited, despite the potential to yield insightful findings. For example, when the components of socio-structural factors are examined in a differentiated manner, it becomes evident that certain elements, such as social support, may influence behavior directly. In contrast, other components, including socio-economic status, for example, seem to exert an indirect effect on behavior (Wolbring et al., 2025). Findings like these lend further support to the ongoing call for a more nuanced examination of socio-structural factor components and their modes of action within the SCT framework. A critical examination is necessary to determine the rationality of integrating these environmental factors within a shared conceptual framework, or whether a more diversified approach would prove more beneficial.

Besides the paths related to socio-structural factors—which were not significant in Publication 2—the findings of Publications 2 and 3 align well with both previous research and Bandura's assumptions. Overall, the studies confirm the strong impact of self-efficacy on behavior. However, the influence of self-efficacy is not confined to its direct effect on physical activity; the findings of Publications 2 and 3 are consistent with Bandura's assumptions that self-efficacy also exerts direct effects on outcome expectations, socio-structural factors, and goals. Additionally, the studies substantiated the indirect effect of self-efficacy on behavior, mediated by both outcome expectations, just like the indirect effect of self-efficacy on behavior mediated by goals, and even the indirect effect of self-efficacy via outcome expectations and goals on behavior was found to be significant.

However, the findings of Publication 3 revealed that some of these effects were not significant for the sample of men, suggesting that the direct effects of self-efficacy seem to be almost exclusively meaningful for men. Men's physical activity may be contingent solely on their self-efficacy, while the influence of self-efficacy on women's physical activity appears to be more multifaceted. Therefore, it is necessary to conduct a more exhaustive investigation to comprehensively grasp the implications of this phenomenon. For instance, research could explore whether certain aspects and mechanisms of action of self-efficacy are more pertinent than others for women.

Publications 2 and 3 contribute to existing literature on SCT by offering a novel empirical validation of the theoretical assumptions underlying the theory. This finding is of particular significance because it addresses one of the most substantial criticisms of SCT: the lack of a holistic model test (Beyera et al., 2022). However, the low amount of variance explained is surprising in view of the good fit of the theory's theoretical assumptions. In Publication 2, approximately 16% of the variance in physical activity could be explained by SCT; in Publication 3, it explained roughly 11%. Notably, SCT explained a greater variance in goals (approximately 31% in Publications 2 and 3) than in behavior. This suggests that something is interfering with the translation of goals into behavior (Sniehotta et al., 2005). This phenomenon, referred to as the "intention-behavior gap", is well-known in various domains and is the subject of numerous theories (Conner & Norman, 2022; Feil et al., 2023; Rhodes et al., 2022). Given the prominence of the intention-behavior gap, the present research does not consider it a deficiency of SCT in particular.

Alternative theoretical frameworks, such as the Health Action Process approach developed by Schwarzer in 1992, have sought to mitigate the intention-behavior gap by strategically integrating post-intentional factors as mediators (Schwarzer, 1992, 2008; Schwarzer & Hamilton, 2020). Specifically, the Health Action Process Approach model subdivides the behavioral modification process into two phases. The initial phase, designated the motivational phase, is characterized by the establishment of goals, encompassing outcome expectancies and self-efficacy, for example, which are also integral components of SCT. Subsequently, a volitional phase involves initiating the pursuit of the previously established goals. The mechanisms of action control and planning assume a pivotal role in this second, post-decisional phase (Schwarzer & Hamilton, 2020), which aims to mitigate the discrepancy between an individual's intentions and their actions.

Some authors therefore advocate for the modification and modernization of SCT to reduce the intention-behavior gap. For example, Beauchamp et al. (2019) state the following:

> Given the pervasive use of SCT, it is understandable that many scholars may be reluctant to revise this framework but, if done, such work might better serve the needs of both researchers and interventionists in the field of sport and exercise psychology, and beyond. (p. 116).

However, before suggesting modifications to SCT and incorporating further mediators to reduce the intention-behavior gap, it is crucial to consider alternative explanations for the proportions of explained variance reported in Publications 2 and 3, given that they are relatively low compared to the average explained variance of around 30% reported in the meta-analyses by Young et al. (2014) and Plotnikoff et al. (2013). One potential reason for this discrepancy could be variations in construct conceptualization and questionnaire selection. As discussed above, the newly developed questionnaire has both strengths and limitations regarding its assessment of the social and cognitive elements of SCT.

The International Physical Activity Questionnaire (IPAQ) Short Form German Version was used to record physical activity. The IPAQ is among the most widely used questionnaires for assessing physical activity behaviors (van Poppel et al., 2010). The IPAQ was developed to standardize the measurement of physical activity and facilitate international comparisons. It was designed to target the general population aged 15–65 years, with the overarching objective of documenting physical activity patterns that encompass both sporting activities and daily routines (Craig et al., 2003). Several versions of the questionnaire were developed, which differ in terms of length (short vs. long form), reference period (the last 7 days vs. a usual week), and administration mode (self-report vs. interviewer-administered). Craig et al. (2003) provide a more detailed presentation of these versions. The essential distinction is between the two lengths—the long form and the short form (Bauman et al., 2009)—which both ask respondents to recall their physical activity behavior over the last seven days (Bauman et al., 2009). The long form comprises 27 items that assess the intensity of four distinct domains of physical activity (occupational, transportation, household, and leisure). The short form only includes seven items and does not differentiate between domains. Instead, its more generic approach measures different intensities of physical activity (vigorous, moderate, and walking) as well as time spent sitting. The short form is thus a simplification of the long form, irrespective of the reference period and the administration

mode. Both questionnaires are analyzed analogously, and the psychometric properties are likewise comparable (Craig et al., 2003). Participants find the short form of the questionnaire to be more acceptable than the long form, and researchers collecting the data likewise report a preference for the short form due to economic considerations (Craig et al., 2003). Therefore, the short form was used for the studies in Publications 1–5. However, the questionnaire is a general measure of physical activity and may lack specificity. Consequently, it is plausible that using the IPAQ short form to assess physical activity contributed to the lower proportion of explained variance in the criterion compared to some previous studies.

In light of their methodological strengths and limitations, the findings of Publications 2 and 3 can be interpreted as providing evidence to substantiate the validity of SCT's theoretical assumptions regarding the elucidation and prediction of physical activity behavior. Although the explained variance was lower than in previous studies, the measurement models provided a good fit to the data. Furthermore, the structural models, considered separately, supported the validity of SCT's theoretical assumptions. These findings corroborate Bandura's critique of the simplification of SCT to its self-efficacy component (Bandura, 2023). Concurrently, however, self-efficacy emerged as a substantial and immediate influencing factor on behavior within the theoretical framework, particularly for men. While disregarding the other influencing factors may appear to be myopic, prioritizing research on self-efficacy seems reasonable, given that the results of Publications 2 and 3 suggest that, irrespective of the precise mechanism of action, self-efficacy could potentially serve as a viable starting point for interventions.

8.1.2 Findings Concerning the Sources of Self-Efficacy

Publications 4 and 5 built upon and expanded Bandura's theoretical assumptions, enriching them with novel findings that enhance our understanding of the genesis of self-efficacy beliefs. One objective of these studies was to ascertain whether some sources of self-efficacy are more significant than others. While this research question is not new, previous studies have not yielded definitive conclusions, and it remains unresolved. Many researchers, including Bandura himself, have presented the sources of self-efficacy within a particular hierarchy of importance (Bandura, 1977; Pajares, 1997; Schwarzer & Luszczynska, 2022). However, there is a lack of empirical evidence to substantiate the rationale behind this sequence. Consequently, the objective of Publication 4 was to utilize an empirical approach

to determine the relative importance of the sources of self-efficacy. An innovative statistical approach, relative importance analysis, was selected for this purpose. Relative importance analysis generates a ranking of variables based on their contribution to the total explained variance. In contrast to regression coefficients, which represent the direct effect of a source on self-efficacy without accounting for its partial effects, relative importance analysis considers these partial effects. The identification of the most influential predictors is therefore predicated on the amount of explained variance each predictor contributes to the total explained variance, considering both its independent and partial effects (Johnson & LeBreton, 2004). Therefore, the concept of relative importance can provide a more inclusive perspective of the roles of the various sources of self-efficacy. Consequently, relative importance analysis was deemed appropriate for evaluating the importance of self-efficacy sources, representing the first time this innovative methodological approach has been used to examine the sources of self-efficacy.

The results of Publication 4 showed that the sources of self-efficacy postulated by Bandura (1977) and Warner (2014) did not possess equal importance in the genesis of self-efficacy beliefs, and their relative importance varied considerably. Mastery experience, verbal self-persuasion, and positive and negative affective states held greater importance for physical activity-specific self-efficacy, while verbal persuasion by others and vicarious experiences appeared to be inconsequential.

These findings somewhat contradict the theoretical assumptions about the hierarchy of sources, particularly regarding the roles of persuasion and vicarious experience. A potential explanation might be that this work did not engage directly with Bandura's original sources but rather with Warner et al.'s (2014) subsequent elaboration, which incorporated nuances concerning persuasion and affect. Considering the face-validity of this progression and the validated German-language scale for documenting the sources of self-efficacy in relation to physical activity behavior, this elaboration was used for the analysis. This facilitates a comparison between our results and those of Warner and colleagues; however, our consideration of six sources rather than four hindered a direct comparison with Bandura's assumptions. For instance, our research indicates that self-persuasion is an important influencing factor, while persuasion by others appears to be less influential. In the context of affect, the nuance was less compelling. Consequently, the extent to which the results may be

altered by using Bandura's four original sources in lieu of the subsequent development remains uncertain.

The innovative evaluation method may also be a reason for the discrepancy in the hierarchies of self-efficacy sources. Previous studies that examined the importance of the sources of self-efficacy used a regression analysis approach that took into account the direct effects of the sources on self-efficacy, but not the partial effects due to the covariances of the sources (Warner et al., 2014). Other researchers have conducted meta-analyses of intervention studies with the aim of determining which self-efficacy source is the most important based on the effectiveness of the interventions for each source (French et al., 2014; Williams & French, 2011). None of these previous approaches definitively answer the research question; therefore, the different methodological approaches may result in different outcomes. However, the various methods used are not incompatible; on the contrary, they can complement each other, thereby enriching our understanding of the genesis of self-efficacy beliefs. For example, the relative importance analysis suggested that vicarious experiences are less important than the other sources of self-efficacy. Furthermore, Warner et al.'s (2014) structural equation model demonstrated that the impact of vicarious experiences on behavior is direct, when one would expect it to be indirect via the mediating mechanism of self-efficacy. While meta-analyses of behavior change techniques (French et al., 2014; Williams & French, 2011) do not explicitly address the significance and mechanisms of the sources of self-efficacy, they nevertheless serve as a valuable foundation for developing interventions informed by the findings of the relative importance analysis. Combined, the findings of this research approaches can pave the way for improved targeting of those sources of self-efficacy that have been identified as particularly important, thereby enhancing the efficacy of interventions.

Given the assumption that an individual's unique experiences interact distinctly to shape self-efficacy, rather than exerting an independent influence (Samson & Solmon, 2011), it seems appropriate to adopt a holistic approach to examining self-efficacy sources. However, most research has investigated the sources of self-efficacy in isolation, independently and as additive factors, failing to provide a joint analysis. Therefore, the goal of Publication 5 was to explore whether there are systematic inter-individual differences in the configurations of the sources of self-efficacy regarding physical activity. By integrating its multifaceted sources, this comprehensive approach intends to facilitate a more thorough understanding of self-efficacy.

A latent profile analysis was used to identify profiles of self-efficacy sources. Latent profile analyses constitute a methodological framework for the aggregation into homogeneous profiles of participants who exhibit analogous responses. The objective is to maximize between-profile dissimilarity, thereby identifying distinct profiles (Vermunt & Magidson, 2002).

The analysis was used to determine homogeneous subgroups within the extensive sample whose respective configurations of sources of self-efficacy were similarly pronounced. As demonstrated in Publication 5, the results indicate that homogeneous subgroups could be identified based on the configurations of the sources. The study identified five distinct profiles in total, each exhibiting variations in sources, self-efficacy levels, and physical activity. The first profile was classified as "driven by distinct negative affect." Members of this profile were characterized by relatively high negative affective state scores and below-average levels for other sources of self-efficacy. This profile was associated with the lowest observed levels of both self-efficacy and physical activity. In contrast, members of the second profile, "acting in a self-regulated manner", demonstrated notably high levels of positive affective states, mastery experiences, and self-persuasion, but a low mean score for sources of self-efficacy influenced by other people. This profile was linked to the highest levels of self-efficacy and physical activity. In contrast to these more extreme configurations, the remaining three profiles were more moderate. Members of the third profile, "driven by missing positive affect", exhibited an average score across four dimensions, with below-average results in the areas of mastery experiences and positive affective states. Members of the fourth profile demonstrated slightly positive mean scores on five dimensions; however, they scored below average on negative affect, leading to the profile name of "driven by moderate positive affect." Members of the fifth profile, "driven by multiple positive sources", reported high values on all sources of self-efficacy except negative affect, for which the mean was exceptionally low.

The holistic perspective on the manifestations of self-efficacy sources thus revealed that they are not expressed independently but exhibit systematic inter-individual differences in their patterns or configurations, which are also reflected in differences in self-efficacy and physical activity. The observed distribution of self-reported profiles across the study population suggests a tendency towards moderation, with a notable proportion of participants admitting to adopting profiles 3 and 4, which are less radical. In contrast, the more

extreme profiles, which are associated with very high or very low levels self-efficacy and physical activity, were less prevalent.

Notably, no profile was predominantly influenced by external factors, such as verbal persuasion by others or vicarious experience. In the case of profile 2, an absence of external influences was observed. This prompts the question of whether one's own “direct” sources of self-efficacy are more relevant (Joët et al., 2011; Sheu et al., 2018) or whether this is a by-product of the sample and behavior studied. The research focused on habitual physical activity behavior and associated self-efficacy. External sources of self-efficacy, such as verbal persuasion by others and vicarious experience, may hold greater relevance in the context of acquiring novel behaviors or even one-off behaviors.

It therefore seemed prudent to replicate the profiles using a more diversified and heterogeneous sample, as well as determine which personal characteristics are associated with specific profiles of sources of self-efficacy. The stability of these profiles over time and across different behaviors must also be addressed in future research, considering both diverse physical activity behaviors and multiple self-efficacy domains.

Classifying individuals according to different profiles is beneficial for intervention research that aims to increase self-efficacy because they clarify which sources should be addressed for each person. However, it remains unclear whether the important sources determined in Publication 4 should be addressed in all profiles, whether weak sources of self-efficacy should be amplified, or whether strong sources should be emphasized, i.e., whether a strengths-based or compensatory approach is more appropriate. Therefore, significant research gaps need to be addressed before an individual support perspective can be adopted.

By combining the results of Publication 4 and 5, this work contributed to addressing research gaps regarding the genesis of self-efficacy beliefs. Using a variable-centered approach, empirical evidence was provided for a hierarchy of the relative importance of the sources of self-efficacy, and Bandura's theoretical assumptions were challenged and expanded. Additionally, using a person-centered approach, it was possible to show that multiple configurations of sources of self-efficacy can lead to favorable self-efficacy and physical activity levels, indicating that there are many conceivable approaches to effective intervention.

8.2 Limitations and Implications for Research and Practice

A notable strength of this research is its use of advanced, innovative and unconventional statistical techniques, which are particularly evident in Publications 2, 3, and 4. Furthermore, these studies drew upon the findings of meta-analyses (e.g., Beauchamp et al., 2019; Young et al., 2014), and thus meticulous care was exercised during the study design process to mitigate prevalent shortcomings. However, beyond the limitations mentioned in each publication, this work has several overarching limitations that should be acknowledged.

8.2.1 Sample characteristics

Although the sample sizes reported in all publications were satisfactory (N_{P1}= 434, N_{P2}= 194, N_{P3}=654, N_{P4}=335, N_{P5}=324), the findings reported in Publications 1–5 are derived from data originating from WEIRD samples. The acronym WEIRD is used to describe participants from Western, educated, industrialized, rich, and democratic backgrounds (Henrich et al., 2010; Nielsen et al., 2017; Nielsen & Haun, 2016). This lack of diversity poses a problem, as "the vast majority of psychological research has been conducted on populations that are unrepresentative of human culture more globally" (Nielsen et al., 2017, p. 31).

Given that the issue of physical inactivity is a global problem (Strain et al., 2024), it is insufficient to investigate physical activity behavior using a sample that is not representative of the majority of the world's population. A more thorough examination of physical inactivity (see Chapter 2.1.4), however, reveals that this phenomenon does not affect all countries uniformly, with certain Western nations exhibiting disproportionately high levels of physical inactivity (Guthold et al., 2018). Therefore, the decision to utilize a WEIRD sample to investigate self-efficacy in the context of physical activity is potentially less problematic than in other research domains given that this population is more severely affected. A re-evaluation of the studies' outcomes must however be carried out in more diverse samples to improve generalizability.

Another limitation of the studies involves the self-selection of study participants, which could influence the findings due to the characteristics of those who volunteered to take part, for example, if they are particularly interested in physical activity or have a positive self-concept. The results may therefore not even be representative of the general populations of Western Europe, the United States, or Germany specifically.

There is a notable underrepresentation of individuals with lower educational attainment and socioeconomic status in the self-efficacy literature (Krys et al., 2025). These individuals often face limited access to educational resources and venues for participating in physical activity. Future research should implement targeted sample planning to ameliorate this issue. Potential solutions may include stratifying the sample, utilizing population-based datasets, or diversifying recruitment locations and procedures.

8.2.2 Using Self-Reports of Physical Activity

Given the multifaceted nature of physical activity behavior, research typically focuses on a particular activity (e.g., the basket shot in basketball) or records physical activity behavior in very general terms (Warren et al., 2010). When aiming to record habitual levels of physical activity, as was the case for this dissertation, it is often recorded in a relatively general and broad manner, as evidenced by national and international studies (e.g., Guthold et al., 2018; Strain et al., 2024). While the assessment of a specific behavior is usually less challenging (McClung et al., 2018; Warren et al., 2010), there is a long-standing debate about how to best assess general, non-specific physical activity behavior (Hills et al., 2014; Warren et al., 2010). A considerable body of research has been dedicated to evaluating the disparities between various recording methodologies and comparing multiple assessment methods (e.g., Prince et al., 2008; Warren et al., 2010). A fundamental distinction is usually made between subjective (self-report-based) and objective measurement methods (Sattler et al., 2021; Warren et al., 2010). Both types of methods were considered for use in this dissertation. Despite technological advancements enabling the assessment of physical activity, self-reports remain the predominantly used measure in health behavior assessment (Sattler et al., 2021), primarily for practical reasons (Steene-Johannessen et al., 2016). Global and short-term recall questionnaires are the most commonly used methods, addressing general and habitual physical activity behavior and physical activity behavior over a defined period of time, respectively. However, there are also numerous other self-report measures for recording physical activity behavior, such as physical activity records or diaries, where activities are documented daily (Ainsworth et al., 2015; Hills et al., 2014). The ease of use, economic management, and cost-efficiency of self-reports have led to their widespread use for the assessment of physical activity (Foa et al., 1997; Steene-Johannessen et al., 2016). However, they are not without criticism; they are susceptible to errors and intentional response

distortion, which can compromise their validity (Arvidsson et al., 2019; Griffith et al., 2007). The majority of self-reports focus on respondents' recollections of individual activity episodes (Hills et al., 2014; Sattler et al., 2021). Respondents are tasked with recalling numerous situations in which they exhibited the studied behavior and subsequently making complex inferences about its average frequency or intensity (Wirfält, 1998), which can lead to unconscious (as well as conscious) biases. These potential inaccuracies could, in turn, impact the quality criteria of the self-evaluation report.

Furthermore, self-reports are vulnerable to deliberate response bias, which can also considerably compromise the measure's psychometric properties. Previous research has demonstrated that health behavior reporting can be prone to faking and deliberate response distortion, potentially resulting in self-reports of limited validity (Egele et al., 2021). For example, previous research has shown that participants can be willing to modify information on their health behavior with patients admitting to withholding information from their clinician and altering the reports of their behavior to create a desired impression (Levy et al., 2018). The phenomenon of conscious response distortion emerges when individuals seek to benefit from creating a desired impression due to perceptions of undesirable or socially unacceptable behavior (Mazar & Ariely, 2006). As individuals may feel compelled to modify their responses undetected, conscious response distortion can compromise the validity of self-reported data and highlight discrepancies between self-report-based and more objective physical activity assessments. Nonetheless, Paulhus and Vazire (2007) posit that conscious response distortion is an exception and that respondents typically try to engage sincerely with the questionnaire and respond with candor, implying that conscious response distortion may not be as pervasive in practice as is sometimes assumed.

Recently, Nigg and colleagues (2020) published best practices for using self-reports to record physical activity behavior, which aim to leverage the advantages and minimize the disadvantages of the method. Specifically, the authors recommend identifying existing and published physical activity questionnaires to address specific research questions, provided they meet certain quality criteria. An informed decision to select a questionnaire might be based, for example, on van Poppel's review of 85 physical activity questionnaires for adults (van Poppel et al., 2010). The authors of the review concluded that no questionnaire was clearly superior to all others in terms of psychometric properties; however, they did note the frequent use of the IPAQ in more recent studies. The prominence of the IPAQ is corroborated

by Sember and colleagues (Sember et al., 2020), who compared the three most widely used international physical activity questionnaires. As self-reports remain the predominant measure for assessing health behaviors (Sattler et al., 2021), and given the IPAQ's renown in the field, it was chosen for evaluating physical activity in Publications 1–5. While the utilization of subjective recording methods may be subject to critique, the determination was made in light of antecedent evidence.

However, the increasing technological progress since the millennium shift (Arvidsson et al., 2019) prompts the question of whether more objective recording methods might prove to be more suitable than self-report techniques (Ainsworth et al., 2015). Objective methods include, for example, the doubly labeled water, which measures CO^2 production, thereby measuring total energy expenditure. However, this method lacks crucial information regarding the intensity, frequency, and duration of physical activity. Additionally, its complexity and cost complicate its implementation. Notwithstanding these limitations, doubly labeled water is considered the gold standard for validating other methods for recording physical activity behavior, thus relegating its role to research rather than practice (Hills et al., 2014).

Accelerometry measures the body’s acceleration in multiple directions, enabling documentation of the intensity, frequency, and duration of bodily movement. Despite their frequent use in research, accelerometers are subject to substantial measurement errors, casting doubt on their reliability (Arvidsson et al., 2019). As Arvidsson notes, a comprehensive consideration of factors such as sensor placement and statistical analysis is imperative for the accurate interpretation of movement data collected by accelerometers.

Pedometers are designed to track the number of steps an individual takes. These devices have become increasingly affordable, facilitating the collection of large quantities of data; they are currently the most popular objective method for recording physical activity (Hills et al., 2014). However, it is important to note that pedometers exclusively record steps, which may not always provide a comprehensive assessment of an individual's physical activity behavior. Additionally, study participants may modify their behavior in response to the presence of these devices, a phenomenon investigated by Clemes et al. (2008), who demonstrated that individuals exhibit heightened reactivity to wearing a pedometer for up to one week, during which time they typically increase their step count significantly.

Each of these methods possesses distinct advantages and limitations. A more comprehensive overview of objective recording methods and detailed breakdowns of individual measures can be found in the publications by Warren et al. (2010) and Hills et al. (2014).

To date, no consensus has been reached regarding which method for recording physical activity behavior is superior, and researchers have concluded that there is still no gold standard (Bassett, 2000; Dowd et al., 2018; Warren et al., 2010). Instead, researchers have gained a heightened awareness of the respective advantages and disadvantages of these methods, resulting in a range of recommendations tailored to specific fields of application and research objectives (e.g., Warren et al., 2010). There is therefore still a robust rationale for choosing to use subjective data collection methods. Nonetheless, future research could replicate the findings of Publications 1–5 using a different measure of physical activity to expand the current findings.

8.2.3 Missing Longitudinal Analyses

Another limitation of this research relates to its temporal scope. The analyses of the sources of self-efficacy (Publications 4 and 5) were cross-sectional, and the tests of SCT's theoretical assumptions (Publications 2 and 3) used only two measurement points one week apart. While the two measurement points represent an improvement over previous cross-sectional studies (Young et al., 2014) and align with the one-week recall of the IPAQ items, the temporal scope of both analyses is limited. To achieve a more comprehensive understanding of the subject, future research should consider shorter and longer time intervals. For example, implementing a condensed time frame and integrating more intensive assessment methodologies, such as ambulatory assessment, could facilitate the monitoring of change and variability within individuals. Conversely, a longitudinal analysis over an extended period could track both the changes and development of the elements of SCT and the sources of self-efficacy. Additionally, the findings of this work should be validated using rigorous testing and evaluation in the context of more applied research.

8.3 Implications for Future Research

The studies included in this dissertation are primarily in the field of use-inspired basic research (Stokes, 2011), which aims to acquire novel fundamental insights and facilitate concrete applications. Consequently, there are myriad starting points for future research. The

following discussion will therefore address more fundamental extensions of the research as well as those of a more application-oriented nature.

For future research, it would be valuable to develop a more extensive and comprehensive scale to assess the elements of SCT. This would not negate the practicality of the short scale developed in Publication 1 but would provide the potential for subsequent research to further validate its results. This development of a new questionnaire could be informed by a systematic overview of previous questionnaires on SCT in the context of physical activity. By establishing a robust foundation for future research and meticulously delineating the strengths and limitations of existing questionnaires, this overview could facilitate the development of a scale that both addresses these critical gaps and adds value. As a long-term objective, creating recommendations for the formulation of items on outcome expectations, socio-structural factors, and goals within the framework of SCT could enable researchers to base their questionnaire development on sound guidelines.

Replicating the findings reported in Publications 2–5 using an objective measure for assessing physical activity would be a reasonable next step. While the findings of several meta-analyses suggest that the method for assessing physical activity behavior may have a negligible influence (Plotnikoff et al., 2013; Young et al., 2014), the ongoing critique of self-report instruments and the proliferation of devices such as pedometers have the potential to enhance ecological validity and practical relevance.

Beyond replication, it would also be interesting to examine the mechanisms of action of SCT's elements over time. While Bandura's original model posited a unidirectional mechanism of action (Bandura, 1977), recent research has begun to challenge the notion that self-efficacy has unidirectional effects on the remaining constructs, suggesting that the mechanisms underlying human action may be more complex and multifaceted. Beauchamp et al. (2019), for example, highlight inconsistencies in the literature regarding the direction of the effects of goals and self-efficacy, and outcome expectations and self-efficacy. However, these findings directly contradict the tenets of Bandura's SCT. Consequently, future research is warranted to address this ambiguity.

Additionally, it is essential that future studies consider the influence of behavior on cognitive and social factors in the context of reciprocal determinism. Bandura hypothesized that these influences do not necessarily occur simultaneously, but manifest on disparate timelines (Bandura, 1978). The influence of behavior on cognitive and social factors may

therefore arise in a more nuanced manner, for example, through behavior acting as a subsequent source of self-efficacy in a future behavior loop (Bandura, 1986), making it prudent to examine the theory from a temporal perspective. The relations between the elements could initially be examined without assuming any causality, for example, by using a network analytical approach. Furthermore, a longitudinal examination of which influences become apparent over time would also be plausible, for example, by employing cross-lagged panel analyses.

Thus, based on SCT, both assessment-related and theory-immanent research questions are apparent. These inquiries are fundamental for developing interventions, because successful long-term and short-term interventions depend on the availability of a reliable and valid instrument for measuring potential changes and clarity regarding the interactions between constructs.

Based on the available findings and taking a more practice-oriented perspective, further research should be conducted to examine the precursors of self-efficacy. The analyses could be replicated with a different scale to capture the originally conceptualized sources of self-efficacy. In addition, research findings by Ashford et al. (2010), for example, indicate that Bandura's hypothesized sources of self-efficacy may not be the only sources to consider. Their meta-analysis found that, in addition to the traditional sources of self-efficacy, feedback on past or others´ performance, for example, was an effective way of increasing self-efficacy. Warner and French (2018) also discussed the possibility of alternative or additional sources of self-efficacy, which should also be investigated and put into context with Bandura´s traditional sources A systematic review could be conducted to synthesize potential sources of self-efficacy from previous studies and meta-analyses, or other possible sources could be identified using a qualitative approach, such as the think-aloud method (Eccles & Arsal, 2017). Then, relative importance and regression analyses could be used to examine the effects and importance of these potential sources on self-efficacy.

As well as the need to broaden the sources of self-efficacy, investigations should endeavor to better understand their effects. Warner et al. (2014) have provided initial evidence that these sources affect not only self-efficacy but some also exert a direct effect on behavior. Therefore, it would be interesting to integrate the sources of self-efficacy into a holistic SCT model and explore their effects on the other model components. This proposal does not flout Bandura's critique that the majority of previous research focuses exclusively on

the effects of self-efficacy (Bandura, 2023), as it does not suggest assessing the effects of self-efficacy per se, but instead proposes to examine the impact of its underlying sources, which are presumed to be distinct entities, on the other model components.

Various research avenues emerge in the context of the sources of self-efficacy. For instance, this dissertation did not investigate the subjective importance of the sources of self-efficacy. Preliminary evidence suggests that individuals rate the utility of different sources of self-efficacy differently (Webb-Williams, 2018). Therefore, it would be appropriate to consider and analyze the relevance of the *objective* importance of sources of self-efficacy as determined using the relative importance analysis in Publication 4, compared to their *subjective* importance as determined by assessments of participants' perceptions of the importance of the sources of self-efficacy. The initial steps of subsequent research could entail exploring whether subjective importance actually deviates from objective importance and whether systematic inter-individual disparities exist. The corresponding evidence could, for example, facilitate the implementation of person-centered interventions that have a higher face validity.

Additionally, future research is required to determine whether the sources' assumed importance also holds in the context of interventions. A substantial body of research has demonstrated that interventions aimed at these sources can indeed exert a positive influence on self-efficacy levels (French et al., 2014; Williams & French, 2011). Specifically, studies could ascertain whether interventions that target the subjectively or objectively more important sources of self-efficacy will yield better outcomes than interventions that target less important sources. The efficacy of interventions targeting the important sources of self-efficacy therefore remains to be elucidated. The potential forms these interventions might assume, as well as their potential adverse consequences, are also yet to be investigated. Reviews by French and colleagues (French et al., 2014; Williams & French, 2011) provide preliminary insights into the potential behavior change mechanisms of interventions that are grounded in sources of self-efficacy. This framework could be extended to examine whether targeting relatively more important sources of self-efficacy yields superior outcomes compared to relatively less important ones.

The interplay between person-centered and variable-centered approaches could be useful in this context. A person-centered approach could be used to classify subjects into

profiles. Then, interventions previously found to be effective could be used to test whether a strength-oriented or compensatory approach is more promising for increasing self-efficacy.

Following a more thorough examination of person-centered approaches, it will be possible to determine how their economy and efficiency can be improved. In light of continuing technological advancements, particularly in the domain of artificial intelligence, there is the potential to enhance interventions by integrating such technology. While increasing self-efficacy in the context of physical activity would be a laudable outcome, it must not be achieved at the expense of an already overburdened and overstretched healthcare system (Zeeb et al., 2025).

Future research could also consider adopting an interdisciplinary approach, with psychologists developing interventions in collaboration with health sector and politics personnel. Such an approach would aim to ensure that the interventions are realistic and applicable to the target population.

8.4 Implications for Practice

To combat physical inactivity over the long term, an understanding of the factors that determine physical activity behavior is essential. SCT has demonstrated its efficacy in explaining and predicting physical activity behavior, and the validation of its underlying theoretical assumptions has significant ramifications for the field of practice.

In light of the findings presented in this dissertation, it is recommended that self-efficacy be given a prominent role in the development of behavior change interventions. This recommendation is based on the demonstrably strong effect that self-efficacy has on physical activity and other influencing factors. A substantial corpus of research exists on the subject of behavioral change and its application to the promotion of self-efficacy in the domain of physical activity (see, for example, the works of Ashford et al., 2010; Stojanovic et al., 2021; Warner & Schwarzer, 2020). The sources determined to be of great importance should be addressed to foster self-efficacy. For instance, the role of mastery experience—the most important source of self-efficacy—can be leveraged to enhance self-efficacy, which, in turn, can impact physical activity behavior. In the context of practice, verbal self-persuasion is also of great interest given the ease with which it could be implemented in interventions to foster self-efficacy.

However, it must be acknowledged that exclusively emphasizing self-efficacy beliefs may not be sufficient to yield optimal outcomes. Outcome expectations also appear to be significant in practical applications, and a close monitoring of outcome expectations related to physical activity, particularly among women, is vital to avert a potential deterioration in physical activity outcomes. Furthermore, the role of goal setting in practice appears especially consequential, as it exerts an influence on behavior and, by extension, on self-efficacy. Taking a holistic perspective, in practice, goal setting appears to hold more importance than initially seemed to be the case. To alter self-efficacy beliefs, it seems essential to set realistic and attainable goals that create mastery experiences. Verbal self-persuasion can facilitate the achievement of these goals, which in turn acts as a mastery experience and increases self-efficacy beliefs. This demonstrates the wide range of potential actions that can be implemented in practice based on the principles of SCT, further elucidating the phenomenon of positive and negative social cognitive self-reinforcing cycles.

The importance of socio-structural factors must also be accentuated. While the starting point of self-efficacy in influencing and optimizing physical activity in a person-centered manner and on an individual level is evident, this approach is somewhat simplistic and may lead to a diffusion of responsibility. This dissertation focused exclusively on individual-level data; however, it is crucial to expand the scope to include population-level analyses and implement interventions at this higher level when addressing the issue of insufficient physical activity (WHO, 2018).

To summarize, in practice, it is advisable to focus on self-efficacy and its underlying sources, for individuals as well as for general practitioners and health care workers. Other cognitive factors should not be neglected, but should instead be deliberately integrated to formulate customized support approaches to enhance physical activity. Additionally, it is imperative to consider environmental factors at the population level, in order to facilitate individual-level behavioral modifications.

8.5 General Conclusion

Given the widespread and increasing prevalence of noncommunicable diseases and their strong association with behavioral risk factors, it is necessary to explore solutions at the individual level and consider optimizing health behavior using evidence-based interventions. However, the notion that personal responsibility is the sole factor influencing physical activity

is overly simplistic. Conversely, environmental and societal structures must contribute to cultivating such responsibility. This structural element is explicitly addressed within the Global Action Plan on Physical Activity 2018–2030 (WHO, 2018) as an addition to personal characteristics, and an emphasis is placed on the role of societal values, traditions, and environments, amongst others.

Thus, improving our understanding of the foundations of physical activity through psychological research is paramount. However, the solution to the worsening problem of the global prevalence of physical inactivity (Guthold et al., 2018; Strain et al., 2024) cannot be left to the psychologists alone. Rather, it necessitates a concerted, interdisciplinary effort that incorporates insights from psychological research

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