

The road towards making the active choice the easy choice

Facilitating and feasibility aspects of children's active transportation



Eva Savolainen

Physiotherapy

DOCTORAL THESIS

The road towards making the active choice the easy choice

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by

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“Knowledge has a beginning but no end”

- Geeta Iyengar

Dedication

 **To my mother and father** 

*Time is too slow for those who wait,
Too swift for those who fear,
Too long for those who grieve,
Too short for those who rejoice,
But for those who love, time is eternity.*

By Henry von Dyke

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Abstract

Children's health is a critical concern, and advocating for their well-being is essential for their future. To promote children's health, it is suggested that they undertake an average of 60 minutes of daily physical activity. However, few children meet this recommendation. In efforts to increase children's daily physical activity, they are recommended to use active transportation to different places such as walking or cycling to school, also known as active school transportation (AST). In accordance with this, the research in this thesis is expected to expand the existing knowledge about children's active transportation. The overall aim of the thesis was to explore facilitating aspects of AST and how to make interventions feasible in a school context. The thesis is composed of four papers; the first is a scoping review, and papers II, III, and IV employ qualitative methodologies. Three papers included children as participants (I, II, IV), while two involved school personnel (III, IV). Data was collected from five separate databases (I), focus groups (IV), photovoice with group discussions (II), and individual interviews (III, IV). The data from the first paper was synthesized into a narrative format, while the analysis for the following papers was done using thematic analysis (II) and latent content analysis (III, IV). The findings indicated that psychosocial factors related to AST include confidence in ability, attitudes, social support, and social norms (I). Additionally, independence in active transportation is central, allowing children to engage more in play, spend time with peers, and connect with their community, thereby enhancing their confidence in their abilities (II). From a feasibility perspective, flexibility, meaningfulness, and support were identified as critical elements for the school personnel in executing the AST intervention (III). Finally, the intervention was attractive to children and school personnel for continued use, and interventions could benefit from engagement, togetherness, and gamification for motivation (IV). In conclusion, this thesis suggests that to make the active choice the easy choice, interventions could accommodate facilitating factors. Peer accompaniment, and the opportunity to engage in playful activities along their route, are particularly important for children using AST. Additionally, fostering independence in daily practices can enhance children's personal development and confidence in their abilities, thereby acting as a facilitator for AST. Flexibility in the execution of the intervention and support including collaboration are key feasibility aspects that should be considered when designing a school-based intervention, particularly given their heavy workload. Understanding the motivations behind school personnel's engagement and their acceptance of the interventions is also important. Visual results, enabled by

progress tracking and gamification, were compelling motivators for teachers to participate in the intervention. Finally, to promote AST and foster children's independence in such behaviour with school-based interventions, it should be made fun and playful for children, and easy for school personnel to incorporate into the school context.

Keywords: Active school travel, feasibility, psychosocial factors, children, teachers, health promotion, physical activity.

List of original papers

This thesis is based on the following original articles, which are referred to in the text by their Roman numerals:

- I. Savolainen, E., Lindqvist, A-K., Mikaelsson, K., Nyberg, L., & Rutberg, S. (2024). Children's active school transportation: an international scoping review of psychosocial factors. *Systematic Reviews*, 13(1).
<https://doi.org/10.1186/s13643-023-02414-y>
- II. Savolainen, E., Lindqvist, A-K., Forsberg, H., & Rutberg, S. Accompaniment, benefits, and community connection: Voicing children's perspectives on independent active transport.
- III. Savolainen, E., Lindqvist, A-K., & Rutberg, S. (2024). Feasibility of a school-based intervention to promote active school transportation – the school personnel's perspective. *Journal of Transport & Health*, 38, 101867.
<https://doi.org/10.1016/j.jth.2024.101867>
- IV. Savolainen, E., Rutberg, S., Backman, Y., & Lindqvist, A-K. (2020). Long-term perspectives of a school-based intervention to promote active school transportation. *International Journal of Environmental Research and Public Health*, 17(14), 5006. <https://doi.org/10.3390/ijerph17145006>

Original articles I, III and IV are published with open access, and paper II is submitted to *Journal of Transport & Health*.

Preface

My dedication to this work stems from a profound desire to enhance children's health and well-being, a goal that has been important to me for a long time now. My academic journey, which began in 2013, earned me a bachelor's degree in health promotion and sparked an eagerness to contribute to a healthier society. Driven by this passion, I pursued a master's degree in public health, which I obtained in 2018. In 2019, when the opportunity to join this project presented itself, I was delighted to accept the offer given my background in health promotion and my desire to advocate for children's health. I found a personal connection with the concept of active school transportation (AST), recalling related childhood memories while recognising its complexity in a rapidly evolving society. Therefore, advocating for physical activity and children's health through AST seemed like an exciting and meaningful research topic. As a result, I have dedicated the past 5 years to understanding the facilitating and feasibility aspects of children's AST.

Sincerely,

Eva Savolainen

Introduction

The WHO-UNICEF-Lancet Commission states, “The evidence is clear: early investments in children’s health, education, and development have benefits that compound throughout the child’s lifetime, for their future children, and society as a whole” (Clark et al., p. 605, 2020). All countries are further encouraged to establish and implement programs aimed at empowering children to maintain healthy levels of physical activity and improve health (Bull et al., 2020). This makes the initiatives promoting physical activity highly significant (Bull et al., 2020). Active transportation including walking or cycling to school, for example, significantly contribute to children’s physical activity levels (Larouche et al., 2020). Investments should recognise citizen participation and community engagement, incorporating the significant influence of children’s voices (Clark et al., 2020). Hence, children aged 0–18 years are placed by the WHO-UNICEF-Lancet Commission at the core of these actions (Clark et al., 2020). This aligns with the United Nations Convention on the Rights of the Child (1989), which emphasises the children’s rights to voice their opinions on matters that directly affect them, always prioritising their best interests. In efforts to contribute to such initiatives, this thesis adopts a health promotive perspective in exploring how children can be supported in improving and maintaining healthy physical activity levels through active transportation. It also aligns with the WHO-UNICEF-Lancet Commissions stance by placing the children at the core of the research included within it.

Health

The World Health Organization (WHO) defined health in its 1948 constitution, asserting it as a fundamental human right (WHO, 1948). The definition, particularly its depiction of complete well-being, has faced challenges over the years, implying an idealized state that categorizes most people as unhealthy (Huber et al., 2011). Regardless, the definition of health has persisted over time and is phrased as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, p.1, 1948; WHO, 2021). In its latest glossary of terms, the WHO expanded this health concept, adding that well-being is “a positive state experienced by individuals and societies” (WHO, p.10, 2021). It was also stated that well-being is a resource for daily life and is influenced by social, economic, and environmental conditions.

Health is further originated in the ability to make decisions and control life circumstances, emphasising the importance of societal conditions that enable individuals and groups to attain health (WHO, 1986). This means that improving health encompasses empowering individuals and groups to establish and achieve goals, cater to needs, and engage with their environment (WHO, 1986). The health concept also covers social and personal resources, as well as physical capabilities needed for daily life (WHO, 1986). In line with this viewpoint, human beings are within physiotherapy viewed as a comprehensive entity of physical, psychological, social, and existential elements interacting with their physical and sociocultural environment (Broberg & Tyni-Lenné, 2019). Health is thus considered a result of these aspects, which include capacity for activity, participation, change, and development. Crucial to the health perspective of physiotherapy is understanding the body, its movement function, and interaction with people and the environment (Broberg & Tyni-Lenné, 2019). Importantly, physiotherapy aspires to promote health, specifically emphasising physical activity (World Physiotherapy, 2023). As such, physiotherapy research holds a pivotal role in promoting physical activity and health in children. However, recent research by Stead et al. (2023) suggests that physiotherapists occasionally find the promotion of physical activity challenging, underscoring the necessity for optimised delivery of strategies to increase physical activity on a societal level.

Health promotion and physical activity

Health promotion is described as the process that empowers people to have more control over health determinants, thereby improving their health (WHO, 1998, 2021). The concept originates from salutogenesis, with its core emphasis on factors that maintain or enhance health (Antonovsky & Elfstadius, 2005). This perspective is derived from observations of individuals ability to sustain health in life situations that would anticipate development of severe stress and even illness (Eriksson & Lindstrom, 2008). In light of this discovery, the idea of health underwent a significant transformation; it became more than the mere absence of diseases, with a shift in emphasis toward resources promoting and maintaining health (Eriksson & Lindstrom, 2008). This is also a central idea within the research included in this thesis. The terms ‘promote’ and ‘facilitate’ can sometimes be used interchangeably. However, in this thesis, ‘promote’ refers to encouraging or supporting specific behaviours, while ‘facilitate’ implies making behaviours easier to carry out. In this context, facilitating a behaviour is closely associated with promoting a behaviour, but they are not identical.

To promote health among children and young people aged 5-17, they are recommended to engage in an average of 60 minutes of daily physical activity, including moderate- and vigorous-intensity activity throughout the week (WHO, 2020; Bull et al., 2020). Physical activity is further defined as “any bodily movements produced by skeletal muscles that require energy expenditure” (WHO, 2020, p. 16) and can comprise a variety of activities such as play and active transportation (WHO, 2020). The recommendations for physical activity are based on the latest evidence, considering health-related outcomes and risk markers for disease, in addition to potential risks associated with physical activity (Bull et al., 2020). The research that informs these recommendations is strong, suggesting substantial benefits for children from adequate amount of physical activity, including physical and mental health (Bull et al., 2020), and academic achievement (Donnelly et al., 2016).

Unfortunately, approximately 80% of children and adolescents worldwide fail to achieve the recommended 60 minutes of daily physical activity (Aubert et al., 2022). Similar trends emerge in Sweden where only 18% of girls and 43% of boys aged 6-11 comply with this recommendation (Delisle Nyström et al., 2018). This low level of physical activity is a global and national issue that underscore the importance of providing more opportunities for physical activity (Aubert et al., 2022). In line with the suggestion that all countries should establish national guidelines and physical activity goals (Bull et al., 2020), Sweden derived their national recommendations on physical activity from the WHO’s 2020 guidelines (The Public Health Agency of Sweden, 2023). One key area for promoting physical activity and health among children is the encouragement of active transportation (Aubert et al., 2022), a subject that has garnered increased research interest due to its practical implications for enhancing children’s physical activity (Pang et al., 2017).

Active transportation

Active transportation commonly includes walking and cycling to or from school, which is referred to as active school transportation (AST) (Mitra, 2013), and outlines the main concept of this thesis. AST can contribute to nearly half of the recommended physical activity for children (Campos-Garzón et al., 2023). It also offers several other benefits, such as fostering environmental awareness and traffic skills (Prezza et al., 2001), and increased well-being (Waygood et al., 2017). However, only around 50% of children globally engage in active transportation (Aubert et al., 2022). In Sweden, 48% of children aged 6-15 use AST in winter,

while 57% do so in the summer (Delisle Nyström et al., 2018). Additionally, a Swedish report by Björklid and Gummesson's (2013) revealed that about half of the children who are driven to school would prefer to cycle or walk. This indicates a substantial opportunity to promote active transportation to school.

A considerable amount of research has been undertaken to understand the challenges associated with AST, aiming to identify ways of enhancing its prevalence. Consequently, traffic, fear of strangers, distance, and lack of support and confidence in ability have been identified as barriers (Aibar Solana et al., 2018; Aranda-Balboa et al., 2020; Lu et al., 2014; Wilson et al., 2018). In Sweden, it has been reported that long distances and safety issues have led to a decline in AST (Faskunger, 2008). However, although the understanding of barriers is an important avenue, it is insufficient to increase AST (Rodrigues et al., 2018; Sirard & Slater, 2008). Hence, researchers have emphasised the importance of concentrating on the facilitating aspects of AST (Lu et al., 2014), with psychosocial factors emerging as a key area of focus (Larouche & Ghekiere, 2018; Sirard & Slater, 2008). This thesis defines psychosocial factors as influences that affect a person psychologically or socially (Upton, 2020). This includes individual and social components such as self-efficacy, attitudes, and social norms, which have the potential to facilitate AST (Sirard & Slater, 2008). However, to the best of knowledge, there is currently a lack of a comprehensive understanding of the psychosocial factors related to AST.

Independent mobility (IM), described as children's freedom to play and move around in local spaces without having an adult with them (Wales et al., 2020), can generate increased AST and physical activity (Schoeppe et al., 2013). Scandinavian countries seem to endorse a higher degree of freedom of IM than others, yet a global decline, including within Scandinavia, have been reported (Riazi et al., 2022; Shaw et al., 2015). This downward trend in IM has been linked with a decline in AST (Faskunger, 2008) and can be attributed to traffic conditions, individual child characteristics, and fear of strangers (Marzi et al., 2018). These factors may in turn be a reason for parents to feel obligated to accompany their child as part of active transportation while struggling to find the time to do so, leading to a common preference for driving as a more convenient option (Forsberg et al., 2020). However, this choice can hinder a child's growth in decision-making skills, self-confidence, and competence in navigating their neighbourhoods (Rissotto & Tonucci, 2002; Tranter & Whitelegg, 1994). Encouraging children to navigate independently to various locations can cultivate a sense of autonomy

in their lives and daily activities (Shaw et al., 2015). Thus, investments to promote IM and AST can positively affect children's health and development, while contributing to environmental sustainability through reduced car usage (Chapman et al., 2018; Marzi & Reimers, 2018). This suggest that employing AST and IM has benefits that extend beyond the individual, aligning with the United Nations Agenda 2030's sustainable development goals for improved health and sustainable communities (WHO, 2018). Establishing such healthy habits in childhood could likely encourage their continuation into adulthood (Clark et al., 2020; Kaseva et al., 2023).

Promoting AST with interventions

Several initiatives have been launched to promote AST, including Walking School Buses (Carlson et al., 2020; Scharoun Benson et al., 2020), Safe Routes to School (Atteberry et al., 2016; Rodriguez et al., 2019), and cycle training programs (Ducheyne et al., 2014; Goodman et al., 2016). Studies have shown that recruiting both children and adult volunteers for Walking School Buses presents significant challenges (Carlson et al., 2020; Scharoun Benson et al., 2020). Conversely, fostering community involvement has been crucial in the success of Safe Routes to School programs (Rodriguez et al., 2019). However, obstacles such as inadequate communication and complex funding regulations need to be addressed in future studies (Atteberry et al., 2016). While cycle training programs have effectively improved cycling competence, their impact on AST rates has not been confirmed (Ducheyne et al., 2014; Goodman et al., 2016).

Over time, reviews have investigated interventions aiming to promote AST. Generally, these reviews have concluded that while interventions have the potential to increase AST, their effects can vary (Chillón et al., 2011; Larouche et al., 2018; Schonbach et al., 2020; Villa-Gonzalez et al., 2018). Consequently, an essential aspect to focus on is long-term evaluations (Roaf et al., 2024) and determining what makes AST interventions work (Larouche et al., 2018; Villa-Gonzalez et al., 2018). To understand this, it is important to acknowledge the complexity of such health-related interventions, as they involve several interacting components (Craig et al., 2008). This includes a high degree of flexibility and customisation, referred to as complex interventions. These types of interventions are prevalent in public health practice and areas with significant health implications, such as education and transport.

The Medical Research Council (MRC) framework for complex interventions divides the process into four phases: development, feasibility/pilot, evaluation, and implementation (Craig et al., 2008). This is an iterative process where researchers can move back and forth between phases based on findings from feasibility or pilot studies (Craig et al., 2008). A detailed investigation of important steps within the evaluation process and exploring the feasibility of the intervention is essential for sustainability (Skivington et al., 2021). Unfortunately, the feasibility phase is often dismissed, leaving out valuable insights into how the intervention works and complicating the development of sustainable interventions (Craig et al., 2008). Feasibility studies strive to fine-tune interventions by a deeper understanding of how they function, facilitating ongoing adaptation and planned evaluations (O’Cathain et al., 2015). Such studies might reveal that the initial intervention was not well-received (Richards & Rahm Hallberg, 2015). Consequently, researchers can modify the intervention to improve its acceptance before broader implementation. Thus, including an analysis of contextual elements that facilitate or hinder is more likely to succeed in developing complex interventions than solely relying on intuitive approaches (Richards & Rahm Hallberg, 2015).

Schools as an arena for interventions to promote AST

Schools are encouraged to promote physical activity by providing supportive spaces for it and physical education, aiding children in forming lifelong habits (WHO, 2020). A whole-school approach is emphasised in the literature as one way to enhance physical activity (Milton et al., 2021), demonstrating potential effectiveness (Timperio et al., 2004). Hence, school-based initiatives are a crucial component of efforts to foster a more active society (WHO, 2018), positioning schools as platforms for health-promoting initiatives. Such initiatives should ideally involve a participatory approach and adhere to the principle of empowerment (Lindacher et al., 2018), aimed at sustaining autonomy and fostering independence and resilience (Tengland, 2016). Therefore, employing an empowerment-based approach in formulating school-based initiatives and engaging end-users – namely, teachers and children – in a participatory manner is likely essential for the sustainability of AST interventions (Lindqvist & Rutberg, 2018).

The social cognitive theory is a frequently used theory in health promotion (Bandura, 2004). It originated as a learning theory and was initially applied to understand violent behaviours (Glanz et al., 2008). Since its inception, the theory has been extensively used to understand behavioural changes related to smoking,

drinking, and human immunodeficiency virus (HIV) prevention (Glanz et al., 2008), and predominately used in physical activity studies (Beauchamp et al., 2019). Research consistently demonstrates a significant, direct link between the theory's self-efficacy construct and physical activity, a relationship often cited together with the theory in relation to the behaviour (Beauchamp et al., 2019). Despite the critical role of self-efficacy as a determinant in the theory influencing health both directly and indirectly, it is important to acknowledge other significant constructs of the theory (Bandura, 2004). Broadly, the theory proposes that self-efficacy, knowledge, outcome expectations, goals, and perceived facilitators and impediments – all of which are associated with three elements (environmental, personal, and behavioural factors) – govern behaviour through a triadic reciprocal causation process (Bandura, 2004). The environmental factors include both facilitating and impeding elements. Personal factors encompass self-efficacy, knowledge, and outcome expectations, whereas behavioural factors embody proximate and distant goals. These elements and constructs influence each other. For example, social support and goal-setting can enhance an individual's self-efficacy. In turn, individuals with high self-efficacy often set higher, ambitious goals and are committed to achieve them (Bandura, 2004). This theory, with its elements and constructs, has been widely adopted in interventions promoting physical activity (McGoey et al., 2015). Thus, the theory may provide a valuable framework for motivating children to develop and maintain healthy habits, such as AST.

Cugelman (2013) has suggested that gamification bears similarities with well-established behaviour change techniques, such as using social norms or social support to encourage someone to adopt a behaviour. Gamification refers to an application of game design elements in non-game contexts (Deterding et al., 2011). In particular, its application is commonplace in education, often generating positive outcomes in motivation and commitment (Hamari et al., 2014). Consequently, gamification may be a promising component in school-based initiatives to enhance motivation towards using AST (Lindqvist et al., 2019; Lindqvist & Rutberg, 2018; Rutberg & Lindqvist, 2018; Rutberg & Lindqvist, 2019). Schools are generally acknowledged as health-promoting environments, fundamental in supporting children's health and advocating for equity (Salvo et al., 2021). However, they also carry numerous responsibilities and a heavy workload for the personnel (Franco et al., 2023). Moreover, limited resources and lack of support hinder adherence to recommendations for promoting health in schools (WHO & the United Nations Educational, Scientific and Cultural

Organization [UNESCO], 2021). Hence, it is critical to have easy-to-implement interventions for schools (Finegood et al., 2010; McSweeney et al., 2017). Notably, only a few studies have explored the school personnel's perspective on interventions to encourage AST. Also, children's perspectives are important in AST research (Wilson et al., 2018), yet the current understanding of these perspectives remains inadequate (Marzi & Reimers, 2018). Accordingly, gaining a deeper understanding of children's and school personnel's perspectives on interventions and related influential factors is essential for promoting AST.

Sustainable innovations for children transporting actively (SICTA)

This thesis is grounded in an intervention, named SICTA, launched in Northern Sweden in 2016. The primary objective of the initiative is to increase the AST rate among children and young people from the current estimate of 50% to 80%. The social cognitive theory was chosen as the underpinning framework for the intervention due to its accountability for social influences on individual behaviour in conjunction with an empowerment-based approach and gamification (Lindqvist & Rutberg, 2018). In the SICTA project, teachers and parents are considered part of the child's social environment and can provide social support as a facilitating factor (Lindqvist & Rutberg, 2018). Personal factors include child engagement through workshops to increase knowledge about AST, along with discussions concerning expected outcomes. Behavioural factors are addressed by tracking AST and weekly curricular tasks. Based on an empowerment and participatory approach, the SICTA intervention was collaboratively developed with input from teachers, parents, and children (Lindqvist & Rutberg, 2018). Gamification elements were integrated to augment the motivation for using AST, thereby enabling the whole group to visually track their progress (Lindqvist & Rutberg, 2018).

The intervention comprised two cycles: one involving second-grade students in the autumn and the other, fifth-grade students in the winter. The initiative started as an analogue version and was further developed into a digital version to offer support and resources via a webpage containing materials for teachers and informational content for parents. The intervention process consisted of five steps: (1) hosting a parental meeting to discuss intervention activities and the benefits of AST; (2) educating children about the benefits of AST; (3) developing curriculum-aligned educational tasks by teachers, which involved real-life observations like counting people and animals on their way to school for class exercises in

mathematics; (4) encouraging children to participate in AST and complete weekly tasks through gamification, enabling them to consistently measure their number of trips and distance travelled; and finally, (5) celebrating their accomplishments.

Rationale

Physical activity is crucial for children's health, and establishing such habits from an early age can persist into adulthood. However, few children adhere to the recommendations for physical activity. To address this issue, active transportation to school is an important area as it significantly contributes to a child's daily physical activity. Despite the rapid growth in AST research and various interventions to encourage the behaviour, more exploration into the factors that facilitate AST, and the feasibility of interventions is required. There is also a notable gap in our understanding of psychosocial factors related to AST. Such knowledge could be invaluable in identifying which factors to address with interventions. Children's insights and experiences should also play a key role in these considerations. An inclusive approach that incorporates children's perspectives into the design and execution of AST initiatives could ensure that the interventions are not only effective but also resonate with the children's needs and preferences. Unfortunately, this has been under-researched; the same applies for the perspectives of school personnel. As schools are a key setting for AST interventions, the involvement of school personnel is essential. Their experiences and views, along with those of the children, regarding feasibility and facilitating aspects are thus vital, although rarely studied. To advance this field of research, this thesis strives to provide insightful contributions about promoting AST by exploring its facilitating and feasibility aspects.

Research aim

The overall aim of this thesis

The overall aim of the thesis was to explore facilitating aspects of AST and how to make interventions feasible in a school-context.

This aim led to the following sub-aims

- I. To scope the literature and identify published research about psychosocial factors related to AST.
- II. To explore children's perspective of independent active transportation in winter conditions.
- III. To explore the school personnel's perspective concerning the feasibility of the intervention and increase the knowledge about what makes an intervention in a school context feasible.
- IV. To explore and describe the participants' experiences one and two years after the intervention was initiated.

Methodological approach

This thesis is broadly based on constructivism, a view suggesting that knowledge is socially negotiated and actively formed by individuals through their experiences, interactions, and interpretations of their environment (Lincoln & Guba, 1985). This perspective aligns with a qualitative approach, which focuses on subjective experiences and meanings, aiming to delve into nuances to uncover rich details and gain an understanding of people's behaviours and social processes. Constructivism also proposes the use of different methodologies to generate knowledge, advocating for the inclusion of multiple perspectives (Dawadi et al., 2021). In this regard, a variety of qualitative methods were used in papers II–IV to deepen our understanding of the feasibility and facilitating aspects of AST. A qualitative design also enables participants to freely express their perceptions and emotions regarding the subject under investigation (Woolley et al., 2018). Although not always the case, the scoping review methodology used in paper I is often conducted from a subjectivist epistemology (Thomas et al., 2020), which harmonizes with the constructivist approach in this thesis.

Design

In paper I, a scoping review was conducted to enable a comprehensive search approach and identify published research about psychosocial factors related to AST, including a variety of study designs (Arksey & O'Malley, 2005). Consistent with the objectives of papers II–IV, we used a qualitative design to gain a detailed and nuanced understanding of the participants' experiences and perspectives. This approach is grounded in the idea that knowledge is formed through the interchange between the participants, the researcher, and the context in which the research is conducted (Lincoln & Guba, 1985). It also acknowledges that participants are experts in their own experiences and interpret their world uniquely (Lincoln & Guba, 1985). AST literature has generally prioritized quantitative over qualitative designs, despite the potential of the latter to enrich our understanding of the behaviour (Wilson et al., 2019). Therefore, employing a qualitative design can provide extended insights into this subject area.

Content analysis and reflexive thematic analysis

The analytical approaches chosen for the qualitative studies bear similarities and differences (Vaismoradi et al., 2013). This has led to occasional interchangeable use of content analysis and reflexive thematic analysis, possibly explained by an absence

of well-defined distinctions (Sandelowski & Leeman, 2012). Some may also argue that reflexive thematic analysis is a process utilized in most qualitative analysis. However, others, including Braun & Clarke (2006), Nowell et al. (2017), as well as myself, consider it as a distinct method. Moreover, content analysis is rooted in communication theory (Graneheim & Lundman, 2004), while the thematic analysis is not theoretically bounded in the same way and can be employed within both realist/essentialist and constructionist paradigms (Braun & Clarke, 2006). However, both methods widely adopt a ‘factist’ viewpoint (Vaismoradi et al., 2013), treating the collected data as a more or less accurate reflection of reality by documenting behaviours, beliefs, and events (Sandelowski, 2010). This perspective aligns with a naturalistic worldview that does not question the facticity of the world (Sandelowski, 2010). The naturalistic worldview proposed by Lincoln and Guba (1985) has later been portrayed as constructivism as it acknowledges and embraces knowledge as being subjective and socially constructed (Lincoln & Guba, 2013). In this light, reflexive thematic analysis and content analysis share clear similarities. However, this does not imply that the application of these methods and the reasons for their utility in this thesis are the same as initially outlined. Content analysis was chosen because of its alignment with the study’s objectives, allowing for the exploration of similarities and differences in the data related to a specific phenomenon, namely the intervention (Elo & Kyngäs, 2008; Graneheim & Lundman, 2004). Thematic analysis was considered suitable for a rich and nuanced interpretation of children’s perspectives on independence in active transportation (Braun & Clarke, 2006). Additionally, thematic analysis has been recommended as a suitable method when photovoice is applied as a data collection technique (Mooney & Bhui, 2023).

Context

This thesis consists of research as part of the larger SICTA project. Each of the four papers has its unique context, which is described briefly below. Paper I includes published research from five separate continents, offering diverse prerequisites for AST and context-related factors that could influence the behaviour. Papers II, III, and IV were conducted in Northern Sweden, including two municipalities with populations of approximately 80,000 and 5,000 respectively. Public schools with varied socioeconomic index were included in papers III and IV, while Paper II included a private school.

The climate of the northern region of Sweden is characterized by harsh winters and brief, bright summers. During the winter season, from October to March, AST is often challenged by the presence of snow and ice, with inhabitants enduring notably freezing conditions. Average monthly temperatures during this period usually range from 0°C to -13°C, although daily temperatures can rise to 13°C or drop to -36°C. The daylight duration in these months varies from 3 to 8 hours, reflecting the shortened daylight hours typical of higher northern latitudes during the winter season.

Participants

Research conducted with children, rather than on them, holds significant value in understanding the complexities of AST behaviour (Wilson et al., 2019). Accordingly, children formed an integral part of the study participants in papers I, II, and IV. Furthermore, the school personnel who play a pivotal role in promoting AST and executing the intervention, were included in papers III and IV. In paper III, teachers, principals, a school nurse, project coordinators and the operation manager were involved, whereas in paper IV, teachers and the principal of the school participated. Since parents usually determine their children’s mode of commuting and significantly influence their lives, studies featuring both children and parents were included in paper I, focusing on psychosocial factors related to children’s AST. An overview of the papers is presented in Table 1.

Table 1. Overview of data collection, data analysis, and participants in Papers I-IV

	Paper I	Paper II	Paper III	Paper IV
Data collection	Scoping review with literature search in five different databases	Photovoice and group discussions	Individual interviews	Focus groups and individual interview
Data analysis	Narrative synthesis	Thematic analysis	Qualitative content analysis	Qualitative content analysis
Participants	Children and parents	Children in grades 4-6 from one school	School personnel from 13 schools that have been involved in the intervention	Children and school staff from one school that participated in the intervention

Paper I

Procedure

Following the scoping review methodology (Arksey & O'Malley, 2005), we defined a set of eligibility criteria based on the Population, Concept, and Context (PCC) framework (Peters MDJ et al., 2020). This paper only included peer-reviewed studies written in English that reported on the psychosocial factors facilitating AST involving children and/or parents. General active transportation research and non-article publications were excluded. We did not apply any date range limitation in the initial search. Table 2 provides an overview of the eligibility criteria.

Table 2. Overview of eligibility criteria

Inclusion/exclusion criteria		
<i>Population</i>	Inclusion	Children aged 6 to 18 years and their parents.
	Exclusion	College or university students.
<i>Concept</i>	Inclusion	Studies with AST as an outcome measure or central phenomenon of interest, where facilitating psychosocial factors among children and/or parents were investigated and reported with respect to how they affect or relate to AST. Studies addressing both facilitating/promoting and impeding psychosocial factors were also included.
	Exclusion	Studies identifying AST as a means for other outcomes such as decreased obesity. Studies that only address impeding factors.
<i>Context</i>	Inclusion	Active transportation to and from school.
	Exclusion	General active travel or general mode choices.
<i>Types of Sources</i>	Inclusion	Peer-reviewed, empirical studies, any study design, written in English.
	Exclusion	Study protocols, conference material, opinion papers, chapters, reviews, and books.

Data Collection

Data for this paper was gathered through searches in Web of Science, ERIC, TRID, PubMed, and Scopus were conducted. The database choice was guided by

the aim (Arksey & O'Malley, 2005), striving to fully capture the interdisciplinary nature of AST research. Following the advice of Arksey and O'Malley (2005), consultations with information specialists about the databases and search strategy were conducted. Prior search strategies used in AST reviews were also considered. Through a group discussion within the research team, the final search strategy was developed, incorporating all these considerations. Two searches were conducted, the first in November 2020 and the second in February 2022. The latter ensured the inclusion of recent literature in this rapidly advancing research area (Rothman et al., 2018). The same search strategy was applied to both searches. The PCC framework for scoping reviews guided the final search strategy (Peters MDJ et al., 2020), which is depicted in Table 3. Table 4 provides the complete search strategy for the Web of Science. The retrieved articles were exported to EndNote and duplicates were removed before the remaining articles were transferred to Rayyan for screening.

Table 3. Overview of search terms

Population
child* OR youth* OR adolescent* OR student* OR pupil*
AND
Concept
“active transport*” OR “active travel*” OR “active commut*” OR “active school transport*” OR “active school commut*” OR “active school travel*”
AND
Context
school*

Table 4. Search strategy for Web of Science

	Search strategy	Results
Date: 2020-11-03	TOPIC: (child* OR youth* OR adolescent* OR student* OR pupil*) AND TOPIC: (“active transport*” OR “active travel*” OR “active commut*” OR “active school transport*” OR “active school commut*” OR “active school travel*”) AND TOPIC: (school*) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, ESCI.	1309
Limits:	None	

Data analysis

An independent and blinded screening of titles and abstracts was conducted by two reviewers (E.S & K.M) using Rayyan software. This was followed by a blinded screening of 163 full texts articles to evaluate their relevance based on the review's eligibility criteria. Subsequently, the screening was unblinded and a Cohen's kappa value of 0.86 was calculated, indicating a perfect agreement according to Landis and Koch (1977). Any disagreements or uncertainties concerning the source selection were resolved through team discussions. A flowchart of the screening procedure is provided in Fig 1. Data from the 77 qualifying studies were assembled using a pre-developed, standardized data charting Excel form. This form was previously tested by charting data from five articles to ensure that it captured all relevant information. The data compiled included 1) article characteristics such as reference, country, aim, design/method, population, outcome variables, and theoretical framework, 2) psychosocial factors, and 3) main findings. Drawing inspiration from Arksey and O'Malley (2005), a thematic approach of the accumulated data was conducted. The results from this analysis are presented narratively in the findings section.

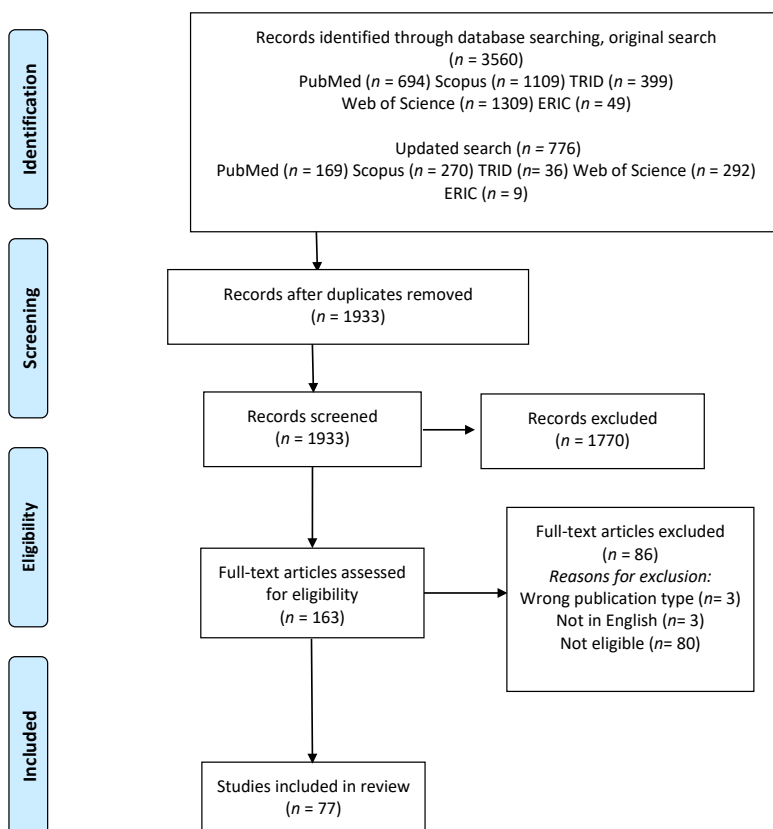


Fig. 1 PRISMA flowchart of the screening process.

Paper II

Procedure

In paper II, centred around children’s independent active transportation, a private school in a northern Swedish municipality agreed to participate. The school principal acted as a link, forwarding the invitation to a teacher of grades 4 to 6. The participants included two separate classes of children aged 10–12 from these grades, including a combined class of fifth and sixth graders. Of the 27 children invited, 20 children (ten boys and ten girls) agreed to participate after obtaining written informed consent from their guardians.

Data collection and data analysis

In this paper, the photovoice method was utilized, inspired by Wang and Burris (1997), to understand children's perspectives on independent active transportation. The process of gathering and analysing data was carried out in four interconnected phases. These phases included 1) involvement of children in the research procedure, 2) discussions with children about their photographs, 3) initial data analysis with the children, and 4) a reflexive thematic analysis of the data. In the initial phase, children actively participated in conversations about the research objectives and data gathering techniques, including considerations of safety and ethics regarding the types of photos to be taken. They agreed to take 1-4 photos that represent their experiences during their independent active transport to school and other places over 2 weeks. These photos were shared with their teacher and forwarded to the researcher (E.S).

In the second phase, children were divided into four groups for discussions about their photos, with each group consisting of 4-7 members. These discussions were facilitated by the researcher (E.S), who was familiar to the children from prior meetings. A pre-tested topic guide was used, along with follow-up questions to enrich the dialogue. Discussions began with an open-ended question that encouraged the children to share their insights and interpretations of their photos, followed by group dialogue. These discussions, conducted in 2023 during school hours, were audio recorded and lasted an average of 48 minutes each. The third phase comprised the initial analysis, with the children actively engaged in line with the photovoice methodology (Wang & Burris, 1997). During this phase, the children were asked to select a photo that best depicted their experiences with independent active transport. The children had the option to select one or multiple photos of their preference, including photos captured by themselves or another child. They were also asked to elaborate on their selections, both individually and collectively, and to ponder underlying implications of their choices.

In the fourth phase, data were analysed using a reflexive thematic analysis inspired by Brown and Clarke (2006, 2019). This analysis focused primarily on children's perspectives, as illustrated through their picture interpretations and subsequent discussions. An iterative process was used, repeatedly moving from raw data to create themes that comprehensively depicted the data. The process started with multiple readings of the data to understand the principal topics covered in the discussions. Subsequently, codes were constructed that encompassed collated

extracts from the raw data. These codes were systematically organised, and initial themes, along with related sub-themes, were created, forming a thematic map. To ensure coherence and prevent information loss, the extracts were revisited, and the themes were reassessed. The final step involved defining and refining these themes based on their essence. This iterative procedure included discussions within the research team concerning the interpretations made and their reasonableness.

Paper III

Procedure

To address the feasibility aspects of the intervention, school personnel were invited via an email, containing detailed information about the study. The invitation was distributed to a total of 37 potential participants from public schools, spanning two municipalities in northern Sweden. Not only teachers, but principals, school nurses, project coordinators, and an operation manager were also invited via email. A total of 19 participants with work experience ranging from one to 34 years chose to participate. These participants represented 13 different schools, both rural and urban. Participants ages varied from 25 to 62 years, with the majority being women ($n = 16$).

Data collection

Data was gathered using individual semi-structured interviews. The collection process spanned from 2020 to 2022 at locations chosen by the participants, which included both physical and online meetings. Each interview, lasting approximately 45 minutes, was audio-recorded, and then transcribed verbatim. The involvement levels in the intervention varied amongst participants; teachers were directly engaged, while other school personnel had less direct roles. The interview guides were appropriately structure to include common themes such as the intervention process, satisfaction levels, attitudes towards the intervention, its perceived fit within the school context, and the perceived intervention outcomes. The data was subsequently analysed using a latent content analysis (see description below).

Paper IV

Procedure

In paper IV, the long-term perspectives of the intervention were addressed. The participants were originally invited via an e-mail to the principal and the two

teachers involved in the 2016 initiation of the intervention. All participants from 2016 were invited to discuss and reflect on their experiences at school. In 2017, 22 girls and 11 boys participated in the subsequent follow-up focus group discussion. In 2018, 19 girls and 22 boys, aged between 9 and 10, participated in these discussions. Parents provided their informed consent at a meeting before their children were invited. Both teachers participated in the 2017 and 2018 interviews, and the principal participated in 2018.

Data Collection

Data was collected through focus groups involving children. Seven groups participated in 2017, and six groups in 2018. These sessions took place during school hours, with each group consisting of four to seven children. To foster open and dynamic discussions, the teachers aided in mixing the children into appropriate groups. Joint interviews with the two teachers were conducted in both years, while the principal was interviewed individually in 2018. Each focus group and interview, which were audio-recorded and transcribed later, lasted for 25 minutes on average. Two separate semi-structured interview guides were used, one for children and one for personnel. The children's interview guide included topics such as actions undertaken so far, favourite and least favourite parts of the intervention, and lessons learned. Conversely, the school personnel guide discussed actions taken, preferred and least valued aspects of the intervention, and teachable moments. This data was later analysed using latent content analysis.

Data analysis of papers III and IV

Papers III and IV utilized a qualitative latent content analysis inspired by Graneheim and Lundman (2004) for data pertaining to feasibility and long-term experiences. The initial steps involved identifying relevant meaning units that met the aims, which were then coded and compared based on similarities and differences. These codes and meaning units were subsequently sorted into initial categories. The contents of these categories were deliberated upon, resulting in new category formations. This process was carried out repeatedly until the final categories emerged. These categories were then abstracted into themes, which were further discussed and renamed if necessary. Throughout this process, there was a continuous review of the original data to ensure alignment with the analysis. Moreover, the entire research team contributed to the analysis, which ensured a diverse representation of the data.

Ethical considerations

All papers included in this thesis, where the research team has performed data collection, adhere to the ethical principles outlined by Swedish legislation and the World Medical Association's Declaration of Helsinki. The Swedish Ethical Review Board has approved the research (No. 2015/496-31Ö, No. 2018-10-31 M, No. 2021-00283, No. 2022-06641-01). As this thesis forms part of a larger project, the knowledge produced enables an ongoing assessment of the intervention to ensure its quality, effectiveness, and accessibility. Special emphasis has been placed on upholding the integrity of the participating children, considering their inclusion in a vulnerable group.

Informed consent

The guardians of participating children were informed orally and via an information letter. This letter outlined the study's aim, methods, research affiliation, any potential discomforts, and anticipated benefits. The same information was communicated to the teachers and children both verbally and in written form. Written informed consent was obtained from all participants. As the children were underage, their guardians provided written informed consent. Participation was entirely voluntary, and any participant could opt to withdraw their involvement at any given time without a requirement for explanation.

Confidentiality

The published material did not include information that could identify individuals, and the data collected was securely stored to maintain participant privacy and confidentiality. Participants were also informed about their rights concerning the personal data gathered during the research process, including information on how to access this data and whom they should contact for additional details.

The risk of harm and benefits

Childhood, a phase of significant vulnerability yet vast opportunities (Clark et al., 2020), requires meticulous consideration of potential harm when engaging children in research (World Medical Association, 2013). Concurrently, children's imaginative ideas and hopes instill them with invaluable voices that deserve amplification (Clark et al., 2020). Children also have the right to voice their opinions on matters directly affecting them (The United Nations, 1989). This underscores the importance of involving children from a rights perspective, which

can be approached by listening to, supporting and taking into account their views (Shier, 2001). The participation of children in this research was rigorously evaluated and centred on voluntary involvement aimed at promoting children's health. Therefore, the primary objective of generating new knowledge with this thesis was deemed not to conflict with the rights or interests of the individual research participants.

Findings

This section presents the main findings, which are elaborated upon in more detail in the individual papers (I-IV).

Paper I

In paper I, 77 articles were included in the review. The characteristics of these articles are detailed in Appendix A. A more detailed description of the evidence sources and the results from each one are available at <https://doi.org/10.1186/s13643-023-02414-y>. The main findings from paper I suggest that confidence in ability, attitudes, social support, and social norms are significantly related with AST. Table 5 provides a summary of these findings. Furthermore, it was discovered that both children and parents attribute these factors, and interventions may have a positive influence on them.

Table 5. Overview of psychosocial factors in relation to AST

Psychosocial factor	Positively related to AST (n)	No relation to AST (n)	Negatively related to AST (n)
Confidence in ability	<i>n</i> = 19	<i>n</i> = 7	<i>n</i> = 0
Attitudes	<i>n</i> = 32	<i>n</i> = 12	<i>n</i> = 0
Social support	<i>n</i> = 31	<i>n</i> = 6	<i>n</i> = 0
Social norms	<i>n</i> = 22	<i>n</i> = 2	<i>n</i> = 1

Confidence in ability

Several studies explored the relationship between confidence in ability and AST, revealing a positive linkage between a child's confidence in ability, as well as their parents', to AST (Table 5). One such study suggested that a parent's confidence in their child's ability has a more significant relationship AST than the child's self-efficacy, while both were correlated with each other (Lu et al., 2015). As Table 6 shows, interventions that either altered the built environment or encouraging AST (Hoelscher et al., 2016), or information dissemination, reflective action, and bicycle training (Stark, Berger, et al., 2018), were positively associated with a child's confidence in ability (Hoelscher et al., 2016; Stark, Berger, et al., 2018). However, while one study reported short-term effects in AST, they were not sustained in the long-term (Hoelscher et al., 2016). Conversely, the other intervention positively affected children's intention towards using AST (Stark, Berger, et al., 2018). Hoelscher et al. (2016) documented improvements in parents' confidence in their child's abilities as well.

Table 6. Overview of interventional effects

Reference	Intervention	Confidence in ability	Reported effects			Children's AST behaviour
			Attitudes	Social support	Social norms	
(Christian sen et al., 2014)	Baseline and follow-up data on a multicomponent intervention involving improvements of non-curricular PA through changes of the physical and organisational environment supported by educational activities	NA	No effect	No effect	NA	Both the intervention and comparison group increased their AST and no significant differences were reported
(Hoelscher et al., 2016)	Baseline and follow-up data on a Safe route to school intervention (SRTS), involving non-infrastructure (encouragement) and infrastructure (engineering) intervention	Positive effects on children's self-efficacy in short term and on parents' self-efficacy among infrastructure schools	NA	Positive effect on parental support	No effect	Positive effects on short term but not on long term
(Lindqvist et al., 2019)	Open questions in a questionnaire and photovoice data on a gamification-based intervention, involving curriculum assignments during AST	NA	Positively affected parent's attitudes	NA	NA	The results show that the intervention motivated the students to use AST
(Rutberg & Lindqvist, 2018)	Focus-group data on a gamification-based intervention, involving curriculum assignments during AST	NA	Positively affected parent's attitudes	NA	NA	The children became highly motivated and put additional effort into AST
(Rutberg & Lindqvist, 2019)	Mixed method data on a gamification-based intervention, involving curriculum assignments during AST	NA	Positively affected parent's attitudes	NA	NA	NA
(Stark, Berger, et al., 2018)	Baseline and follow-up data on an intervention involving three elements: (i) information, (ii) reflection and (iii) action	Positive effect on child's perceived behavioral control in test group	Positive effect on attitudes in the test group	NA	No effect	Positive effect on intentions in the test group

Attitudes

Generally, both children's and parents' attitudes were positively related to AST (Table 5), although the relationship between attitudes and walking versus cycling differed. One study found a positive relationship between a child's attitude and

walking but not cycling (Stark, Meschik, et al., 2018). Meanwhile, parents' attitudes were linked to their intentions to allow their children to cycle to school but not walk (Forsberg et al., 2021). In addition, both peer support (Yu & Zhu, 2016), and social norms (Jing et al., 2018) were reported to be positively related to parents' attitudes. An intervention study involving information, reflection, and action noted positive effects on children's attitudes and reported positive changes in the intention to use AST (Stark, Berger, et al., 2018). However, enhancements to non-curricular physical activities did not have any effect on children's attitudes or AST (Christiansen et al., 2014). Qualitative intervention studies found that a gamification-based intervention positively shaped parents' attitudes and potentially increased the use of AST by children (Lindqvist et al., 2019; Rutberg & Lindqvist, 2018, 2019).

Social support

Social support from peers, parents, and teachers was generally found to be positively related to children's AST (Table 5), although some studies showed mixed results. For example, one study found a positive relationship between social support and AST only among boys (Leslie et al., 2010). Another study reported that parental support was positively related to AST in boys, while peer support was positively related to AST in both boys and girls (Camargo et al., 2020). Conversely one study identified a positive relation between parental support and AST, but no such relationship between peer support and AST (Long et al., 2015), while another study reported the opposite (Nunes de Oliveira et al., 2020). Furthermore, Van Kann et al. (2016) identified a positive link solely between being a parent who actively travels and AST, with no relation found with social support. An intervention study showed that changes in the built environment had a positive effect on social support and led to a short-term effect on AST (Hoelscher et al., 2016). However, another intervention study focusing on improvements in non-curricular physical activity found no effect on either social support or AST (Christiansen et al., 2014).

Social norms

Social norms were generally positively related to AST as indicated in Table 5. However, results differed among various studies. For instance, one study found a significant relation only between perceived usage of AST and AST, not between perceived approval or social pressure regarding AST usage (Jing et al., 2018). A qualitative study indicated that parents who consider themselves good parents when they safely drive their children to school are more inclined to encourage

AST usage among their children if they witness other children using AST (Forsberg et al., 2020). While the effect of interventions on social norms was investigated, no effects were identified (Hoelscher et al., 2016; Stark, Berger, et al., 2018).

Paper II

The reflexive thematic analysis revealed one main theme and two subthemes (Table 7). The main theme “Accompaniment, benefits, and community connection – Navigating the pathways of freedom” illustrates that children not only value their independence but also appreciate their companionship with friends and, at times, adults. This autonomy allows them to interact socially, enjoy themselves, and take part in creative play, all of which are treasured by them. Moreover, they emphasised the importance of familiarity and connections within their community, boosting their confidence to safely navigate their journeys. These various facets of the children’s experiences are delved into more deeply in the subthemes.

Table 7. Overview of the result

Main theme	Subthemes
Accompaniment, benefits, and community connection – Navigating the pathways of freedom	Enjoying the independence while recognising the benefits of having someone nearby
	Having the opportunity to move independently enables us to connect with the community

Enjoying the independence while recognising the benefits of having someone nearby

The children described their range of independence in active transportation, covering distances from 1.5–5 km from home, and sometimes even longer. They typically decide on their mode of transport with their parents. The children appreciated their independence, typically preferring it to adult accompaniment. They recognised benefits such as contemplative time, quality moments with friends, and the opportunity to engage in playful activities during their independent travels. These activities ranged from playing with snowballs and competitions to imaginative play, like pretending to be in war scenarios or zombie apocalypses. They mentioned that such activities were unlikely to occur in the presence of adults. The children also highlighted the importance of companionship and occasionally expressed fears when out alone. Notably, they were concerned about slow-moving cars and interactions with unfamiliar adults. Fear, especially in the dark, stimulated their imaginations with scary scenarios, although some found tranquillity during the dark hours. To manage this, various strategies were adopted, including seeking the accompaniment of a friend or adult, carrying a phone for reassurance, and choosing well-lit routes when possible.

Having the opportunity to move independently enables us to connect to the community

Children's ability to independently travel to school and various places allowed them to explore their local environment, fostering a sense of connection with their community. This familiarity cultivated feelings of safety, as they perceived watchful eyes from a distance. Notable landmarks, such as a familiar industrial building, a frequently visited restaurant, or a community events stage, held significant value, and augmented this sense of community connection. This exploratory activity not only strengthened their connections with people but likewise cultivated their appreciation for their environment – encompassing nature, art, and animals. They shared moments of being captivated by their surroundings, including recalling cherished memories or simply admiring nature's beauty, situations that could feel awkward in adult company. The children also expressed a preference for cleanliness and modernity in their environment, including spaces free from litter and up-to-date bus stops, voicing concerns about potential insecurity should litter become a widespread issue.

Paper III

In paper III, the latent content analysis identified one main theme and three subthemes, conveying the school personnel’s perspective on the feasibility of the intervention and its essential components (Table 8). The main theme “Crossing the threshold – enter and you might feel at home”, reflects the perceived threshold in dedicating the anticipated time and effort to the intervention. This reluctance was tied to the many responsibilities of the school personnel, causing scepticism concerning the burden of implementing the intervention. However, key elements encompassing flexibility, meaningfulness, and support were identified as making the intervention more acceptable and less overwhelming than initially anticipated. These three critical areas are further described in the subthemes.

Table 8. Overview of the results

Main theme	Subthemes
Crossing the threshold – enter and you might feel at home	Flexibility for integration in the school context
	Sensing meaningfulness is essential for being worth the effort
	A supportive design to enhance enthusiasm

Flexibility for integration in the school context

The teachers appreciated the flexibility to tailor the intervention to their individual circumstances, viewing it as crucial for its integration into their current teaching strategies. While a timeline encompassing 4 weeks was generally seen as manageable, the teachers also noted the necessity for time flexibility to accommodate holidays and additional commitments. Flexibility concerning the number of assignments completed during the intervention was also valued, as external factors sometimes increased the workload. These factors could include sick leave, administrative responsibilities, or the challenges associated with managing mixed-age groups. To increase participation, a few teachers modified the intervention to incorporate physical activities like walking around the school yard during recess.

Sensing meaningfulness is essential for being worth the effort

The participants described a meaningful purpose as essential when integrating an intervention into a school context. They believed that the willingness to engage in the intervention may be affected if its benefits were not apparent. Yet, they acknowledged several of its benefits and underscored the importance of promoting physical activity for children’s health and learning abilities from a public health perspective. This was their primary motivation for participating in the

intervention. They also noted that when children perceive their participation as fun and valuable, teachers also find it worthwhile and enjoyable. The participants needed to see actual results from their actions. They all observed changes, including enhanced awareness among children regarding their physical activity levels and, in some instances, a perceived increase in AST. The intervention also yielded additional advantages like enhanced class solidarity, increased alertness, and practical experiences. It further led to decreased car usage among parents and an increase in bicycles in the schoolyard. A few of the teachers did not find it necessary to continue since most of the children used AST. However, all participants desired to continue advocating physical activity and would encourage others to implement the intervention.

A supportive design to enhance enthusiasm

Due to the COVID-19 pandemic, initial meetings like kick-off and parental meetings were omitted, despite their perceived importance in fostering enthusiasm among teachers and parents. Collaboration within the school and with external parties, such as the project coordinator, was particularly significant during the early stages of the intervention but was also valued beyond the initial phase. Clear expression of expectations along the chain of command, from the operational manager to the teachers, was conveyed as helpful to clarify the execution of the intervention. Support in various forms, such as drawing inspiration for assignments from the website, receiving in-class health information from a school nurse or physical education teacher, or viewing informational videos for parents and children, aided in planning the intervention. Most teachers used the website to record children's active transportation distances in kilometres, and tracking their collective progress on a map was described as a highly engaging feature for the children and appreciated by the teachers.

Paper IV

In paper IV, as outlined in Table 9, the latent content analysis resulted in one main theme with three subthemes. The main theme, “Unity for an active community – Making the active choice the easy choice”, encapsulates the collective experiences of both children and teachers as uncovered in the subthemes. These subthemes define critical elements necessary to ensure the feasibility and sustainability of the intervention. Collectively, these highlighted aspects emphasise the importance of executing the intervention as a joint community effort. This collaborative approach allowed AST to become a habitual practice, thus making the active choice an easy choice.

Table 9. Overview of the results.

Main theme	Subthemes
Unity for an active community-Making the active choice the easy choice	Well begun is half done-Engagement sparks motivation
	It takes two to tango-Keep moving with togetherness and gamification
	Jumping on the bandwagon-From project to everyday use

Well begun is half done-Engagement sparks motivation

The first subtheme encompasses critical factors for initiating the intervention, including engagement, involvement, and active participation, which all influenced the participants’ initial motivation. The opportunity of incorporating routine curriculum assignments to bolster learning was viewed as beneficial for motivating the participants. Motivation could reportedly be enhanced through three strategies: increasing children’s involvement in designing of assignments, involving personnel and the entire class, and a supportive organisational environment.

It takes two to tango-Keep moving with togetherness and gamification

The second subtheme pertains to essential insights for advancing the intervention beyond its initial stage. This included promoting the collective completion of tasks and cultivating a sense of unity. The need to address differences in interests, skill levels, and learning styles within the curricular tasks was also emphasised. Moreover, tracking and showcasing group progress, along with providing rewards upon achieving class-wide goals, were viewed as essential elements for continuing the intervention. The importance of social factors was underscored by the

children, who enjoyed having a friend accompanying them on walks or bike rides. They stated that the teacher's commitment and enthusiasm enhanced their dedication to task completion and AST usage. This sentiment was echoed by the teachers, who considered dedication a key component in a successful application of the intervention.

Jumping on the bandwagon-From project to everyday use

The third subtheme focuses on the perceived impact of the intervention on participants and their long-term adherence to it. This consideration involves the motivation to maintain new habits, changes made by the school in favour of AST, and an overall sense of enhanced well-being. The children consistently walked or biked throughout the year, with few exceptions, and did not deliberate much over their transportation choices, displaying a desire to continue using AST. The intervention resulted in reduced traffic near the school, particularly as more classes adopted AST, incorporating it into the school's concept. The children took pride in their involvement, aspiring to share their experiences and serve as AST ambassadors. It gave them a sense of freedom and reduced stress, as the children could travel to school independently, providing them with additional time at home in the morning. The use of AST also enhanced their overall well-being, as they felt more alert and were able to concentrate better during school hours.

Discussion and reflections

The overall aim of the thesis was to explore facilitating aspects of AST and how to make interventions feasible in a school context. The findings of paper I highlighted that psychosocial factors such as confidence in ability, attitudes, social support, and social norms were positively related with AST, demonstrating their potential to facilitate such behaviour. Moreover, these psychosocial factors could potentially be influenced through interventions (I). In paper II, it was found that children derive enjoyment from their independence in active transport. Being independent enabled them to connect with their community, which fostered a sense of safety and confidence in their ability. Similarly to the findings in paper I, social support was seen to facilitate children's independence in active transport in paper II and was also viewed as a highly valued benefit by the children. From the perspective of school personnel, flexibility, meaningfulness, and support were identified as key aspects in achieving feasibility in paper III. The long-term results in paper IV indicated the intervention's appeal for reuse, with engagement, togetherness, and gamification as essential factors for its repeatability. The facilitating aspects of AST are discussed initially, followed by a discussion on the feasibility of the intervention. However, these facilitating, and feasibility aspects are intertwined in some cases. Thus, the discussion may, at times, alternate between aspects related to both these facets.

Facilitating aspects of AST

The findings of facilitating aspects are summarised into three categories. The first, 'togetherness', refer to social facets including community, social support, and social norms. The second, 'enjoyment', pertains to attitudes, and perceived benefits. The third, 'personal development and confidence in ability', include matters of independence.

Togetherness

The findings of this thesis underscore the significance of collective efforts, or togetherness, in facilitating AST. This encompasses elements of social support (I, II, IV), community (II), and social norms (I), all of which may play a pivotal role in shaping children's choice of transportation mode and their independent use of them.

Broadly, support from friends and family was highly important for children's AST use and achieving independence. This aligns with studies that underline significant links between peer and parental support and physical activity, emphasising the importance of encompassing social environments in interventions (Reimers et al., 2019). Notably, the social environment, including community, surfaced in this thesis's findings. As demonstrated in paper II, peers and familiar community members held importance for children's independence. This concurs with a previous review suggesting a positive association between the social environment and children's IM (Marzi et al., 2018). Similarly, Zwerts et al. (2010) highlighted social aspects as a key part in children's travel modes. The social environment further plays a pivotal role in enhancing parental perceptions of safety (Holt et al., 2016), marking it as an important aspect as parents are often the gatekeepers of children's AST. Additionally, children recounted feeling safer in the company of peers (II). This type of support in relation to children's IM is sparsely explored (Riazi et al., 2022). Yet, observations from Sweden have noted that children can transform perceived dangers into exciting adventures with friends during their independent travel (Wales et al., 2020).

In paper I, social norms were identified as a psychosocial factor that was positively related to AST. The findings also suggest a potential distinction between observing others' behaviour and perceiving social pressure from others; the former may be more influential. This inference aligns with Ravis and Sheeran (2003) findings that descriptive norms (observing others' behaviour) can have more influence on health-related behaviour than subjective norms (social pressure). They further purposed that young people are particularly receptive to descriptive norms, implying that the use of peer role models could aid interventions in promoting such behaviours (Ravis & Sheeran, 2003). However, this thesis does not offer sufficient insights to comprehend these aspects fully. Despite this, the findings underscore the importance of social factors as potential facilitators for both AST and IM, thereby contributing with valuable insights to the existing knowledge base. These findings echo Riazi et al.'s (2019) recommendation to focus on modifiable factors, including social correlates, when promoting active and independent transport among children. The findings on social factors offer practical insights into addressing these modifiable factors, such as peer accompaniment.

Enjoyment

This thesis's findings underscore that children's enjoyment of AST, their attitudes towards it, and their perception of its benefits are key elements in facilitating its use. Enjoyment of the mode of transport was linked to the perceived benefits of independence, including time spent with friends and opportunities to engage in playful activities and contemplation (II). Having fun was identified as a significant motivator for using AST (IV). This enjoyment could act as an autonomous form of motivation for this behaviour (Ryan & Deci, 2000), previously found to be positively associated with the use of AST (Burgueno et al., 2019). However, that study also posited that adolescents are not likely to use AST solely for enjoyment. Their use of AST is more related to an alignment with their identity and values (Burgueno et al., 2019). Such findings differ slightly from ours, potentially due to the younger age bracket of children in paper II and IV compared to their study. When contrasted with adolescents, younger children may be more driven by experiencing enjoyment (Owen et al., 2014). Further, the opportunity to socialize with peers – a highly valued perceived benefit – made their mode of transport choice more enjoyable (II). Valuing perceived benefits such as social aspects might also be a way of fostering motivation to use AST (Ryan & Deci, 2000). Additionally, the findings from paper I demonstrated that both children's and parents' attitudes were predominantly positively related with AST and could be influenced by interventions. This relationship is consistent with research concerning physical activity (Cortis et al., 2017; Pasi et al., 2021), indicating promising pathways to facilitate AST by targeting attitudes, which may incorporate both enjoyment and perceived benefits.

Personal development and Confidence in ability

The findings of this thesis further indicate that aspects of personal development and confidence in ability hold significant importance for AST. Children's confidence in their ability and parents' confidence in their child's ability was positively related to AST in paper I. This aligns with research on physical activity (Cortis et al., 2017), and parallels the social cognitive theory, which demonstrates both direct and indirect links between the belief in one's ability and behaviour (Bandura, 2004). The term 'personal development' mainly refers to the results from Paper II, showing that independence provides children with opportunities to familiarise themselves with their community, thereby increasing their confidence in their ability to safely navigate their neighbourhoods independently. Similar results can be observed in a prior review on the subject, which highlights

how children's perceived safety and competencies facilitated active transportation (Buttazzoni et al., 2023). Notably, parental perception of the neighbourhood is associated with children's IM, and both a child's and parent's confidence in the child's ability are positively associated with the behaviour (Villanueva et al., 2014). Paper II's findings further suggest that independence leads children to engage more in playful activities both alone and with friends, which are critical aspects of a child's development (Niemistö et al., 2019). This may promote higher physical activity levels alongside social interaction and the cultivation of social skills (Marzi & Reimers, 2018). Exercising independence in activities like active transportation also foster a sense of autonomy (Shaw et al., 2015). However, parents can sometimes underestimate their children's abilities (Forsberg et al., 2020), and their overprotection can in turn deprive their child of essential skills and knowledge needed to navigate their neighbourhoods' independently (Malone, 2007). Nevertheless, this thesis reveals that independence enables children to develop strategies for encountering scenarios that involves potential risks (II). Studies corroborate this, showing that children aged 10–12 can manage the risks they encounter when navigating their local communities (Christensen & Mikkelsen, 2008). These risks and their management strategies are unique to individual limits, competencies, and experiences (Kvalnes & Sandseter, 2023). Observations of children aged 4–5 indicate that they can also assess risks during play based on past experiences (Sandseter, 2009). Therefore, it is highly important to provide children with opportunities to exercise their competencies (Brando, 2020). This is particularly crucial during the acquisition of fundamental skills, as past experiences can profoundly influence their risk management strategies. Fostering confidence in the ability and personal development can enhance AST for children, which is partly achievable through practising independence in daily activities.

Feasibility aspects of AST interventions in a school context

The findings of feasibility aspects are summarised into three categories. The first, 'flexibility', refer to adaptable facets that allows for tailoring of the intervention. The second, 'engagement', pertains to both school personnels and children's engagement, including meaningfulness and having fun. The third, 'support', include matters of supportive components that are, or should be included in the intervention. The findings from papers III and IV indicate that the intervention was attractive and repeatable for school personnel, a critical factor related to acceptability from a feasibility perspective (Bowen et al., 2009). The findings highlight the integral role of flexibility, engagement, and support in executing the

intervention feasibly. Even though paper III's findings suggested an initial threshold in assimilating the intervention into teachings, it was considered manageable and its components conducive to the integration process. Therefore, this thesis exhibits that aspects such as flexibility, engagement, and support are fundamental to feasibility, and the findings may offer valuable insights for supporting intervention feasibility in a school context.

Flexibility

Flexibility was a highly valued aspect of the intervention, as it enabled teachers to tailor it to their unique circumstances. This aligns with Vanwolleghe et al.'s (2014) assertion that flexible interventions, allowing customisation to fit a school's requirements are more feasible. Such flexibility can also instil a sense of manageability (III), corroborating Wood and Bandura's (1989) advisement of manageable tasks to enhance efficacy beliefs. This flexibility also resonates with the intervention's empowerment-based approach, enabling school personnel to partake more in decision-making processes that concern them (WHO, 1998). In real-world applications, as Durlak and DuPre (2008) argue, empowering individuals to influence situations according to their needs and preferences is a crucial contextual factor. Concurrently, the intervention should be flexible enough to adapt to school personnel's circumstances without researcher involvement, embodying an empowerment-based approach. This adaptation often involves aspects of how the intervention is customized in different populations (Bowen et al., 2009). The papers III and IV's findings, which explore different intervention experiences, suggest that adaptations are relevant to teachers' workloads and other responsibilities. This insight is valuable for comprehending intervention sustainability: what element have been adapted and why, and which components remains of the original intervention (Shelton et al., 2018). As Scheirer and Dearing (2011) pointed out, adaptation is an integral part of intervention processes that often aids in facilitating implementation. By inference, findings from papers III and IV suggest that core intervention elements can remain as envisioned, but curricular assignments may receive varying degrees of effort depending on workload. Skivington et al. (2021) state that exploring feasibility is key to an intervention's longevity, and flexibility seems to be crucial for making the intervention feasible. This is especially true in a school environment, where personnel often grapple with high workloads (Franco et al., 2023; Ryan et al., 2022). Hence, these findings underscore the importance of flexibility, both in the intervention in this thesis and for future school-based interventions.

Engagement

The aspects of personal engagement emerged as crucial, including finding the intervention meaningful (III) and having fun (IV). To enhance motivation, it may be critical to align the intervention with the end-user's goals and values. This can be facilitated by a sense of autonomy (Ryan & Deci, 2000), and achieved through an empowerment-based approach (Alsop & Heinsohn, 2005). Hence, involving end-users in the development of the intervention and employing an empowerment approach (Lindqvist & Rutberg, 2018), appeared valuable for intervention feasibility. Teachers needed to witness their actions yield results to fully engage and perceive the intervention as meaningful (III). This corroborate with a central aspect of complex interventions, suggesting that the end-users' motivation may be compromised if they engage in interventions and then perceive the anticipated results as negligible (Richards & Rahm Hallberg, 2015). Several benefits from the intervention were perceived by the school personnel, such as the potential to increase students' physical activity and improve alertness during classes. These findings coincide with past research that shows teachers' motivation to participate in activities that enhance learning conditions and improve student behaviour (Mahar, 2011). This underscores the importance of motivating teachers to incorporate interventions into their duties (Vanwollegem et al., 2014). Therefore, belief in an intervention's potential outcomes and experiences that align with these expectations is vital for motivating them to include health-promoting interventions in their responsibilities.

The findings of this thesis suggests that the gamification element, which enabled continuous AST measurement – represented by a visual depiction of group progress – could bolster participant engagement. Measuring AST in this manner was both feasible and well-received by teachers, and it was exciting for the children and increased their motivation for AST (III, IV). As such, gamification may be one key component in making the intervention meaningful and enjoyable from both teachers' and children's perspectives. The findings also suggest that children's engagement in the intervention and their willingness to use AST were reinforced by witnessing the success of others and receiving encouragement from peers and teachers. The rationale behind this may be that verbal persuasion and vicarious experiences can influence an individual's belief in their capabilities (self-efficacy), based on the social cognitive theory (Bandura, 1977). This aligns with the general idea behind the intervention and, as such, may strengthen the applicability of the social cognitive theory in AST interventions. These findings suggest that

understanding the motivations driving school personnel to undertake such responsibilities is important for the feasibility of a school-based intervention. Ensuring the intervention yields tangible results and aligns with their goals and values can foster this willingness. Additionally, including a visible progress tracker or gamification elements can aid in providing such tangible results.

Support

Papers III and IV indicate that various forms of support contribute to the perceived feasibility of employing the intervention. A highlighted aspect of support was collaboration, previously demonstrated to aid in implementation through proactive planning for potential barriers and problem-solving (Hivner et al., 2019). Collaboration can also strengthen individual belief in capabilities (Wood & Bandura, 1989), suggesting its importance in developing school-based interventions. The findings also highlighted the value of a supporting webpage, providing assignment ideas and informational letters to make the planning process easier for teachers. This type of support appears to be unique in AST intervention literature. Although informative webpages about interventions are common, the specific support needed for schools to facilitate physical activity must be considered (WHO, 2018). Both social and informational support seem valuable for the feasibility of AST interventions from a school personnel perspective. Therefore, support within interventions can enhance applicability, particularly as schools often lack resources to function as health-promotion arenas (WHO & UNESCO, 2021).

Methodological discussion and reflections

Scoping review

The scoping review methodology can provide an overview of relevant research but may not delve deeply into the results of the included studies (Arksey & O'Malley, 2005). For this reason, paper I offers a preliminary guide when psychosocial factors are the focus, largely due to the cross-sectional design of the examined articles which does not establish causal relationships. By exclusively including published, peer-reviewed research in Paper I, we ran the risk of excluding unpublished information, thus amplifying publication bias (Schlosser et al., 2007). This issue was partially addressed by conducting a second search over a year later, which did not disclose any fresh insights that altered the narrative from the initial search. Additionally, the use of a narrative format in paper I enhances its accessibility for non-academic readers, such as policymakers (Peterson et al., 2017). This approach is also identified as a strength of scoping reviews.

Qualitative inquiry

The concept of methodological rigour, in terms of the trustworthiness of qualitative research (Lincoln & Guba, 1985), is applicable in both content analysis (Graneheim & Lundman, 2004) and reflexive thematic analysis (Nowell et al., 2017). These were the analytical methods used in the qualitative papers of this thesis. Lincoln and Guba (1985) refined the concept of trustworthiness by establishing criteria to parallel those used in the quantitative assessment of validity and reliability. These criteria include credibility, dependability, transferability, and confirmability (Lincoln & Guba, 1985).

Credibility

Credibility refers to the extent to which the findings accurately reflect the collected data, which can be improved through techniques such as triangulation and peer debriefing (Graneheim & Lundman, 2004; Lincoln & Guba, 1985; Nowell et al., 2017). Our research team conducted peer debriefings during each stage of the papers analysis. The purpose of this peer debriefing differs between content analysis and reflexive thematic analysis: in content analysis, peer debriefing primarily served as achieving consensus (Graneheim & Lundman, 2004), while in reflexive thematic analysis, it fostered reflexivity to obtain richer interpretations over consensus (Byrne, 2022). Additionally, the research problem was considered through various professional perspectives as a part of triangulation (Lincoln &

Guba, 1985). To improve credibility, we supplemented the analysis with direct quotes from the participants in each paper (Graneheim et al., 2017; Graneheim & Lundman, 2004; Nowell et al., 2017). By involving a diverse range of participants – including children from second to sixth grade, second- and fifth-grade teachers, principals, a school nurse, project coordinators, and an operation manager, we were able to capture a wide spectrum of perspectives, thereby strengthening credibility (Graneheim et al., 2017; Graneheim & Lundman, 2004).

Dependability

Dependability refers to data stability over time (Graneheim & Lundman, 2004), which was particularly prominent in papers III and IV as data collection spanned over an extended period. This was managed using interview guides to ensure consistent questioning (Graneheim & Lundman, 2004), incorporating both main inquiries and possible follow-up questions. Dependability in research can also pertain to the inquiry's reasonableness (Lincoln & Guba, 1985), and can be achieved by making the research process logical, traceable, and well-documented (Nowell et al., 2017; Tobin & Begley, 2004). This enables readers to evaluate the research's dependability effectively (Lincoln & Guba, 1985). To substantiate this procedure, each paper offers a detailed depiction of the inquiry process. These depictions of the research methods have been authenticated through the preservation of primary data, annotations, and transcripts (Nowell et al., 2017).

Transferability

Transferability refers to the degree of which the findings can be transferred to other context or respondents, which in qualitative research is an interpretation made by the reader (Graneheim & Lundman, 2004; Lincoln & Guba, 1985; Nowell et al., 2017). For the reader to assess this, the researcher must provide a thorough description of the research for those who might want to apply the findings (Lincoln & Guba, 1985). Therefore, a description of the participants and context was provided, while ensuring participant confidentiality was respected. Furthermore, the variety of perspectives included in this thesis, which represent a wide range of experiences, contributes to enhanced transferability (Lincoln & Guba, 1985).

In relation to this, it may be important to acknowledge the embracing of knowledge being subjective and socially constructed. This includes an emphasis of understanding multiple perspectives and the role of interpretation and meaning making in research, with findings derived from a deep exploration of subjective

experiences. Therefore, it should be noted that the findings of this thesis may offer valuable insights for extending our understanding of promoting children's physical activity through AST, rather than presenting a single truth (Tobin & Begley, 2004).

Confirmability

When credibility, transferability, and dependability are established, confirmability can be achieved (Lincoln & Guba, 1985). Confirmability refers to the process of ensuring that the researcher's interpretations and findings are based on the data (Tobin & Begley, 2004). It requires researchers to demonstrate how they arrived at their conclusions and interpretations. This includes explaining theoretical, methodological, and analytical choices throughout the study, enabling others to comprehend the decision-making process (Tobin & Begley, 2004). To ensure that critical information about the research process was included in the papers, we employed the Consolidated Criteria for Reporting Qualitative Research (COREQ) (Tong et al., 2007). Moreover, it should be noted that when engaging with a text like a transcribed interview there are always levels of interpretation involved (Graneheim & Lundman, 2004). This constitutes a critical issue when striving to achieve trustworthiness within content analysis (Graneheim & Lundman, 2004). In efforts to fulfil the objectives of papers III and IV, which include providing a deeper understanding of experiences and perspectives related to the intervention, we endeavoured to retain the participants' stories while abstracting their underlying meanings. In paper II, where a reflexive thematic analysis was conducted, we strived to capture the essence of the material in our interpretations, while ensuring that the children's voices remained prominent. This strive may have helped to ensure that the interpretations did not deviate excessively from the raw data.

Photovoice

In paper II, the photovoice method was applied, a research technique that uses photography to empower and involve participants (Wang & Burris, 1997). It is often used in community-based research to provide a voice to marginalized groups and examine complex societal issues from their viewpoint (Wang & Burris, 1997). This method mitigates issues of power and representation by encouraging participants to shape the research agenda and challenge prevailing narratives. As such, photovoice was considered an appropriate method for collecting data from children, to empower them and reduce potential power dynamics between the

researcher and the participants. However, the rationale for using photovoice has also faced criticism for potentially reinforcing power differences, especially if participants are treated as a marginalized group (Sutton-Brown, 2014). Despite children often being described as a vulnerable group in the literature, including earlier in this thesis, they have never been treated as such in meetings. Instead, the emphasis has been on empowering them, encouraging them to raise their voices, and involving them in research that pertains to them. It has been clearly stated that they hold the right to partake in decisions concerning them and that their opinions are significantly valued. As such, the children included in this thesis have been portrayed as powerful forces with a profound value of their own.

Focus groups and individual interviews

The imbalance between young people and adults can be managed through focus groups by shifting the balance of power towards the participants and away from the researcher (Raby, 2010). Moreover, teachers assisted in forming groups based on their familiarity with the children, aiming to create a safe space and facilitate an open and dynamic discussion. Focus groups can additionally stimulate participants' thoughts and remind them of their feelings about the subject under investigation (Holloway & Galvin, 2017). There is a possibility that individual interviews could have yielded different data (Woolley et al., 2018), however, the findings suggest that the material offers diverse insights into the participants' experiences. In paper III, interviews were regarded as more suitable due to a reduced power imbalance. Individual interviews are also a flexible method of gathering in-depth information, allowing participants to explore and reflect on their thoughts (Holloway & Galvin, 2017). The participants have more control over the interview, as their individual stories are prioritised (Holloway & Galvin, 2017). Moreover, individual interviews were seen as more convenient for the school personnel, as they could choose a suitable time and place during their working hours, potentially increasing their opportunities to participate. Although focus groups could have generated more spontaneous ideas about the intervention (Holloway & Galvin, 2017), the individual interviews provided a diverse yet cohesive depiction of the school personnel's views and experiences of involvement in the intervention.

Conclusion and implications

In conclusion, this thesis offers valuable insights into the factors that can facilitate children's AST and independent active transport, suggesting potential strategies for promoting these behaviours. The findings demonstrate that togetherness, enjoyment, coupled with personal development and confidence in one's abilities were important factors related to children's AST and their independence in such behaviour. Togetherness emphasises the importance of community, social support, and norms, suggesting that from a child's perspective, accompaniment is a key facilitator for AST. Hence, accompaniment could take central place when designing interventions seeking to facilitate AST. Enjoyment, including attitudes and the perceived social benefits, also emerges as a considerable facilitating aspect for AST among children, indicating that having fun and playing together is important to them. Furthermore, the findings suggest that attitudes towards AST could be affected by interventions, demonstrating potential paths for promoting such behaviour by targeting enjoyment and perceived benefits. Additionally, children's personal development and confidence in abilities can be nurtured by engaging in daily practices of independence, thereby facilitating AST. This underlines the empowering aspects of enabling children to navigate their environment independently when using active transportation. Consequently, providing such opportunities can uphold several of their rights, including health, participation, and development, ultimately enabling them to become active agents in their own lives.

The findings highlight essential aspects in making a school-based intervention feasible, including flexibility, engagement, and support. School personnel frequently struggle with substantial workloads, making flexibility a critical aspect of intervention feasibility within the school context. This accentuates the potential of flexibility as a key factor, advocating for its retention in this thesis project and its inclusion in future works. To ensure the feasibility of a school-based intervention, it is also important to understand the motivations that drive school personnel's engagement and their adoption of such interventions. Tracking progress and incorporating gamification elements appear to be key aspects in providing visual results from their actions, which serve as strong motivators for the teachers to engage in the intervention. Furthermore, the findings underscore that school personnel derive distinct advantages from both social and practical support, including collaboration and customised online information. Ultimately, the findings illustrate several specific needs important for school personnel, which need

to be incorporated to make AST interventions feasible. This highlights the significance of an empowerment-based approach in developing such interventions.

Considerations for the future

While the findings of this thesis make a significant contribution to this field of knowledge, they also raise unanswered questions that require further research. The findings broadly suggest that togetherness, enjoyment, personal development and confidence in ability can be important facilitators. However, the findings provide limited insight into the practical application of these facilitators within interventions. Exploring the effectiveness of these facilitators for AST regarding their mediating role in such behaviours, including identifying optimal strategies for their use in interventions, is a significant avenue for future research. Regarding intervention feasibility, this thesis delivers considerable knowledge on making an intervention feasible from the school personnel's perspective. Yet, as these findings are drawn from small-scale research and do not include measures of effectiveness, further examinations in broader trials are necessary. Moreover, the project is now available to the public through a Swedish organisation named Generation Pep and is highlighted as a good example of public health interventions in a recent report from the Swedish Government Office. This visibility may offer opportunities to explore if and how the research is translated into practice at a societal level, which would be an intriguing issue for additional research in this area regarding implementation.

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My contributions into this project

The work featured in this thesis is part of a broader project, SICTA. As such, parts of the work were planned for when I entered the project. For paper IV, all data was already collected, and the idea of exploring the feasibility of the intervention and key factors related to active transportation was established from the outset. My contribution to paper IV involved data analysis and writing and editing the original draft. Conversely, for papers I-III, I participated in the planning, organising, data collection and analysis, as well as in writing and editing the original drafts.

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Appendices

Appendix A: Table of characteristics of sources

Characteristics of sources (n = 77)		Count (%)
Study design	Qualitative	10 (13%)
	Quantitative	63 (82%)
	Mixed method	4 (5%)
Study participants	Children and Parents	23 (30%)
	Children	27 (35%)
	Parents	23 (30%)
	Children, parents, and other adults	4 (5%)
Continent	North America	29 (38%)
	Europe	29 (38%)
	Oceania	15 (19%)
	South America	2 (3%)
	Asia	1 (1%)
	Multiple continents	1 (1%)
Publication year	2006-2013	13 (17%)
	2014-2021	64 (83%)
Theoretical framework*	Social ecological model	11 (14%)
	Social cognitive theory	9 (13%)
	Theory of planned behaviour	9 (12%)
	Self-determination theory	3 (4%)
	Multiple frameworks	4 (7%)
	Theory of reasoned action	1 (1%)
	Ecological and cognitive active commuting (ECAC) model	1 (1%)
	Pathway model	1 (1%)
	Social marketing	1 (1%)
	Social Norms Approach (SNA)	1 (1%)
	The Travel Socialization framework	1 (1%)
	Integrative model of behaviour prediction	1 (1%)

* The percentage in the theoretical framework section is calculated on the total number of articles ($n = 77$) (Savolainen et al., 2024).

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