"It has to be fun to be healthy" Assessing the implementation and teacher-perceived effectiveness of a school-based physical activity program



PhD thesis

Julie Dalgaard Guldager

Unit for Health Promotion Research Faculty of Health Sciences, University of Southern Denmark 2019

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© Julie Dalgaard Guldager Department of Public Health, University of Southern Denmark Department for Research and Development, University College South Denmark

Academic advisors

Primary supervisor Professor Anja Leppin, PhD Department of Public Health, University of Southern Denmark

Co-supervisors

Professor Pernille Tanggaard Andersen, PhD Department of Public Health, University of Southern Denmark

Docent Jesper von Seelen, PhD Department for Research and Development, University College South Denmark

Assessment committee

Associate professor Lars Breum Christiansen, PhD (Chairman) Department of Sport Science and Clinical Biomechanics, University of Southern Denmark

Associate professor Emily Darlington, PhD Department of Health Services and Performance Research, Claude Bernard University Lyon 1

Associate professor Mette Aadahl, PhD Department of Public Health, University of Copenhagen

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Paper I:

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Paper II:

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Paper III:

Guldager, J. D., von Seelen, J., Andersen, P. T. & Leppin, A. (2019). **Do student background and school context affect implementation of a school-based physical activity program?** *Under review*.

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Abbreviations

AAYR	Active All Year Round		
CI	Confidence Interval		
CBPA	Class-room based physical activity		
FASIII	Family Affluence Scale III		
HBSC	Health Behavior in School-aged Children		
MRC	Medical Research Council		
MVPA	Moderato-to-Vigorous Physical Activity		
OR	Odds Ratio		
STC	Systematic text condensation		
TPE	Teacher-perceived effectiveness		
χ^2	Pearson's chi-square test		

Summary

Background: Physical inactivity causes 3.2 million deaths each year.¹ Low levels of physical activity among children are especially worrying, since habits established in childhood are found to track into adulthood.² In Denmark, 59% and 56% of 13-year old girls and boys, respectively, do not reach the recommended level of physical activity of at least one hour of physical activity every day.³

In the pursuit of increasing activity levels of children, programs have been developed in and for many different settings, with an emphasis on schools where most children can be reached regardless of their family's socioeconomic status.⁴ Evidence for the effectiveness of school physical activity programs is, however, mixed, with some studies reporting positive findings⁵ and others reporting their program not to be effective or to be effective for certain subgroups only.⁶⁻⁸ There can be many reasons for these differing results, such as the quality of the program itself, the duration and/or intensity of the program, the didactics used etc. Another reason for these inconsistent findings could be rooted in implementation challenges, where program implementation is successful in some social contexts and unsuccessful in others. However, not much is known yet about which target group characteristics and which parts of social context affect implementation. The PhD project attempted to contribute to this research area, using the "Active All Year Round" (AAYR) program⁹ as an example. AAYR is a three-week long nationwide school-based health promoting program which has been offered annually to all Danish school classes since 2006. The main vision of the program is that "it has to be fun to be healthy" with the aim of promoting healthy habits regarding health and physical activity in particular. Through program material, students conduct daily healthy activities in the pursuit of becoming the healthiest school class in the country.

Aim: The overall aim of this thesis has been to investigate whether, and if so, which target group characteristics and aspects of social context affect implementation as well as teacherperceived effectiveness, of the "Active All Year Round" program. The specific objectives of the thesis were to examine:

 Do school social context factors affect teacher-perceived effectiveness of the program? (paper I)

- How do teacher-perceived feasibility of program implementation as well as implementation barriers, program reach and the programs' influence on social cohesion? (paper II)
- Do student level and school level context factors affect level of program implementation? (paper III)

Methods: Multi methods were used as means of data collection. For **paper I** a crosssectional questionnaire survey was conducted among teachers nationwide who had implemented the program in 2015 in any elementary/primary school class in Denmark. The questionnaire was distributed to 5.892 teachers, 2.097 of who completed it (response rate of 36%). Program effectiveness was determined as teachers' perceptions of positive change in physical activity levels and attitude towards physical activity in the participating students.

Paper II of the thesis was based on a qualitative approach and intended to uncover teacherperceived feasibility of program implementation, potential barriers affecting the process as well as program reach and the programs' influence on social cohesion in class. Sixteen individual interviews were conducted with teachers from sixteen different schools who had implemented the program in 2017 in a fifth-grade (9-11 years) school class. The interviews were conducted with the help of a semi-structured interview guideline and lasted between 30 to 60 minutes. Data were analyzed by systematic text condensation.

The goal of **paper III** was to study whether student social background (gender, immigration background, family affluence and perception of school connectedness) and school context factors (school size, proportion of parents with low SES within the whole school, existence of a school physical activity policy and schools' prioritization of health promotion) affect implementation level. Data were gathered from 16 5th grade classes in 16 different schools which participated in the 2017 program. Schools were randomly selected from within prior defined geographical clusters. From the resulting list an even number of schools with children from higher as compared to lower educational family background were approached for participation. Students filled out a standardized questionnaire (N = 276) as did the teachers who had implemented the program (N = 16). Furthermore, in-class observations of program implementation were conducted in each of the school classes. Implementation level

was determined for each school class based on the criteria of "reach", "dose delivered", "dose received" and "fidelity". Data were analyzed by multilevel linear regression analysis.

Results: The results from the first study (paper I) indicated that teacher-perceived effectiveness of the program varied as a function of school context factors, specifically schools' prioritization of health promotion, teachers' satisfaction with school principal support for implementation of the program and teachers' satisfaction with the schools' physical environment for implementing physical activity. The second study on teachers' perceptions of implementation feasibility and barriers (paper II) revealed that the teachers found it easy to implement the program and identified very few barriers for implementation, the most noticeable being lack of time. Further, program reach was perceived to be very high. Students less confident in being physically active were included in the activities to a similar degree as those with high confidence about their ability, and the program influenced social cohesion in class in a positive manner. Finally, the third study on the possible connection between selected context factors and implementation level (paper III) showed in the multivariable analysis that the program was implemented to a higher degree for students who had a stronger sense of being connected with their school and at schools with a generally higher parental SES level.

Conclusions: To conclude, context does matter in implementation and the PhD thesis has added to the body of literature by identifying contextual factors which affect implementation. School-based physical activity programs cannot be expected to be implemented in the same way in different schools in different contexts. Future developers of health promotion programs can utilize this knowledge in their program design to facilitate better implementation adaptable to the local context. Future research can build upon these results by investigating a broader range of contextual parameters including the community level and by assessing not only the perspectives of students and teachers, but also those of parents and the schools' head masters.

Sammenfatning

Baggrund: Fysisk inaktivitet forårsager 3,2 millioner dødsfald hvert år.¹ Lavt niveau af fysisk aktivitet blandt børn er særligt bekymrende, idet vaner etableret i barndommen kan fortsætte ind i voksenalderen.² 59% og 56% af 13-årige danske piger og drenge opnår ikke det anbefalede niveau af fysisk aktivitet på mindst en times fysisk aktivitet om dagen.³ Der er udviklet interventioner i og for mange forskellige arenaer i håbet om at kunne øge niveauet af fysisk aktivitet blandt børn. Der har været et specielt fokus på skolen som en arena, hvor de fleste børn kan nås uafhængigt af deres families socioøkonomiske status.⁴ Evidensen for effekten af skolebaserede interventioner målrettet fysisk aktivitet er dog blandet, hvor nogle studier har afrapporteret positive effekter,⁵ har andre afrapporteret, at deres program ikke havde nogen effekt eller kun havde effekt for nogle specifikke grupper af elever.⁶⁻⁸ Der kan være mange årsager til disse forskellige resultater, så som programmets kvalitet, længde og/eller intensiteten af programmet, den didaktik der bliver anvendt osv. En anden årsag til disse inkonsistente resultater kan være udfordringer med implementeringen af programmet, hvor implementeringen kan være succesfuld i nogle sociale kontekster og ikke succesfuld i andre. Dog vides der endnu ikke meget omkring hvilke karakteristika ved målgruppen (eleverne) og hvilke dele af den sociale kontekst, der kan påvirke implementering. Denne Phd afhandling har forsøgt at bidrage til dette forskningsområde ved at bruge Aktiv Året Rundt (AÅR) kampagnen som et eksempel. AÅR er en tre uger lang landsdækkende gratis skolebaseret sundhedsfremmende kampagne, der er blevet tilbudt årligt til alle danske skoleklasser siden 2006. Kampagnens vision er, at det "skal være sjovt at være sund", og målet er at fremme sunde vaner i forhold til sundhed generelt, men specielt i forhold til fysisk aktivitet. Via kampagnemateriale udfører eleverne dagligt sunde aktiviteter i en stræben efter at blive den sundeste skoleklasse i landet.

Formål: Det overordnede mål med denne Phd afhandling har været at undersøge hvorvidt, og hvilke karakteristika ved målgruppen samt aspekter ved den sociale kontekst der kan påvirke implementering og lærer-opfattet effekt af Aktiv Året Rundt kampagnen. De specifikke målsætninger i denne afhandling var at undersøge:

 Påvirker skolens sociale kontekstfaktorer lærernes opfattelse af effekten af Aktiv Året Rundt kampagnen? (artikel I)

- Hvordan er lærernes opfattelse af gennemførligheden af kampagnens implementering, samt barrierer for implementering, programmets "reach" og programmets påvirkning på klassens sociale samhørighed? (artikel II)
- Påvirker kontekst faktorer på elev- og skole-niveau implementeringen af kampagnen? (artikel III)

Metoder: Dataindsamlingen blev gennemført ved hjælp af flere metoder. For **artikel I** blev en tværsnitsundersøgelse gennemført blandt lærere over hele landet, der havde implementeret kampagnen i 2015 i en dansk folkeskole. Spørgeskemaet blev distribueret til 5,892 lærere hvoraf 2,097 af disse udfyldte det (svarprocent på 36%). Kampagnens effekt blev bestemt ud fra lærernes opfattelse af forandring i niveauet af fysisk aktivitet samt holdninger til fysisk aktivitet blandt de deltagende elever.

Artikel II i afhandlingen var baseret på den kvalitative tilgang og havde til formål at afdække lærernes opfattelse af, om kampagnens implementering er gennemførlig, samt barrierer for implementering, programmets "reach" og programmets påvirkning på klassens sociale samhørighed. 16 individuelle interviews blev udarbejdet med lærere fra seksten forskellige skoler, der havde implementeret kampagnen i 2017 i en fjerdeklasse (9-11-årige elever). Interviewene blev udført ved hjælp af en semi-struktureret interviewguide og varede mellem 30 og 60 minutter. Data blev analyseret ved hjælp af systematisk tekst kondensering.

Målet med **artikel III** var at analysere hvorvidt kontekst faktorer på elev- (køn, indvandringsbaggrund, socioøkonomisk status ("family affluence") og opfattelse af skolesamhørighed ("school connectedness") samt skole niveau (skole størrelse, andel af forældre på skolen med høj socioøkonomisk status, forekomsten af en politik for fysisk aktivitet og skolens prioritering af sundhedsfremme) påvirker implementeringen af kampagnen. Data blev indsamlet fra 16 fjerdeklasser på 16 forskellige skoler, der deltog i kampagnen i 2017. Skolerne blev tilfældigt udvalgt fra pre-definerede geografiske klynger. Fra denne liste blev et ligeligt antal skoler med elever fra højere og lavere familiemæssig uddannelsesbaggrund spurgt, om de ville deltage i forskningsprojektet. Eleverne (n = 276) samt de lærere der havde implementeret kampagnen (n = 16) udfyldte et standardiseret spørgeskema. Derudover blev der udført observationer af kampagnens implementering i hver skoleklasse. Implementeringsniveau blev bestemt for hver skoleklasse baseret på

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kriterierne: "reach", "dose delivered", "dose received" og "fidelity". Data blev analyseret ved multilevel lineær regressionsanalyse.

Resultater: Resultaterne fra den første undersøgelse (artikel I) viste, at lærernes opfattelse af effekten af Aktiv Året Rundt kampagnen varierede som en funktion af visse af skolens sociale kontekstfaktorer. Disse faktorer var skolens prioritering af sundhedsfremme, lærernes tilfredshed med den støtte de fik fra deres skoleleder i arbejdet med implementeringen af kampagnen, samt lærernes tilfredshed med skolens fysiske miljø for fysisk aktivitet. Den anden undersøgelse af lærernes opfattelse af kampagnens gennemførlighed, samt barrierer for implementering (artikel II) viste, at lærerne fandt det nemt at arbejde med kampagnen og identificerede meget få barrierer for implementering, hvoraf den mest mærkbare var mangel på tid. Desuden blev programmets "reach" opfattet som værende meget høj. Elever, der var mere usikre i forhold til at være fysisk aktiv, blev inddraget i aktiviteterne i samme grad som elever, der ikke var usikre i forhold til at være fysisk aktiv, og kampagnen påvirkede klassens sociale samhørighed positivt. Endeligt viste den multivariable analyse i den tredje undersøgelse af den mulige sammenhæng mellem udvalgte kontekst faktorer og implementeringen af kampagnen (artikel III), at kampagnen i højere grad blev implementeret blandt elever, der havde en højere opfattelse af skolesamhørighed ("school connectedness") og på skoler med en generel højere andel af forældre med høj socioøkonomisk status.

Konklusioner: Resultaterne af denne afhandling viser, at konteksten betyder noget i forhold til implementering, og afhandlingen har bidraget til den eksisterende litteratur ved at identificere de kontekstuelle faktorer, der påvirker implementering. Det kan ikke forventes, at skolebaserede sundhedsfremmeprojekter implementeres på samme måde på forskellige skoler i forskellige kontekster. Fremadrettet kan udviklere af sundhedsfremme projekter anvende denne viden i deres projektdesign til at facilitere bedre implementering, der kan tilpasses til den lokale kontekst. Fremtidig forskning kan bygge videre på disse resultater, ved at undersøge en bredere skare af kontekstuelle parametre, inklusiv lokal- samfunds niveau, og ved også at inddrage forældrenes og skolelederens perspektiv.

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Papers I - III

Chapter 1 Introduction

1. Introduction

"It is not evidence-based programs that are effective, but it is <u>well-implemented</u> evidence-programs that are effective^{"10 (p. 1124)}

Joseph A. Durlak¹⁰ put forth this statement in his article on the importance of studying implementation of school-based health promotion programs. Still, after reflecting on this statement I was left curious to know: If well-implemented evidence-programs are effective, which factors then affect the implementation of these programs?

This introduction will begin with outlining the topic of this PhD. Thereafter, the health consequences and prevalence of physical inactivity will be briefly highlighted, followed by a short description of the Danish school setting. Finally, different international and Danish school-based physical activity programs will be presented, with a special emphasis on the "Active All Year Round" program which is the school-based physical activity program this PhD is centered around.

1.1 Preface

This PhD thesis has explored which factors affect implementation of the school-based physical activity competition program "Active All Year Round" (*AAYR*). Specifically, I have investigated social context and target group characteristics and studied if and how these influence implementation as well as teacher-perceived effectiveness of the AAYR program.

Three papers are included in this thesis, with three objectives leading to fulfill the overall aim described above. Two quantitative papers focus on: the school social context and teacher perceived effectiveness (**paper I**) and school social context as well as target groups characteristics, and their influence on program implementation (**paper III**). Finally, a qualitative paper (**paper II**) explores teachers' experiences of implementation, with a focus on implementation feasibility, barriers, reach and the programs' influence on social cohesion. The objectives of the three papers will be specified in chapter 3.

1.2 Physical inactivity among adolescents

Physical inactivity is highly relevant for public health, as sufficient levels of physical activity provide important health benefits, and physical inactivity is related to chronic disease risk factors such as for instance high cholesterol level, high blood pressure and obesity.¹¹ In

2010, physical inactivity was estimated to account for 3.2 million deaths worldwide and 2.8% of Disability-Adjusted Life Years.¹

Most adolescents (ages 11 – 15) across 32 European and North American countries do not meet the recommendations for physical activity.¹² This thesis follows the WHO's definition of physical activity of being "defined as any bodily movement produced by skeletal muscles that requires energy expenditure"^{13 (p. 1)} and that "physical activity includes exercise as well as other activities which involve bodily movement and are done as part of playing, working, active transportation, house chores and recreational activities".^{13(p1)} Despite efforts to increase physical activity participation, we have only seen a slight increase from 17% of adolescents in 2002 to 18.6% in 2010 meeting the recommendations for physical activity.¹² It is worrying that from 2002 to 2010 nine of the 32 countries (Denmark, Italy, Scotland, Switzerland, Czech Republic, Lithuania, Russia, Slovenia and USA) witnessed a significant *decrease* in adolescents' levels of moderate-to-vigorous physical activity (*MVPA*).¹²



Figure 1: Percentage of 11, 13 and 15-year old Danish adolescents who conduct at least 7 hours of leisure time moderate-to-vigorous physical activity per week, 2002 – 2018.

Adapted from Rasmussen et al.³

In Denmark, since 2002 we have seen an increase in 15 year old boys and girls meeting the recommendation of at least one hour of physical activity per day.³ However, for the 11 and 13 year old girls, levels of MVPA have been fairly steady, whereas levels of MVPA have declined considerably for 11 and 13 year old boys in recent years (see Figure 1).³

Furthermore, from 2014 to 2018 there was an increase among 11-year old boys and 13year old boys and girls who did no MVPA at all in their leisure time (not shown in table).³ Thus, despite an increase in MVPA among the eldest of Danish adolescents, the levels of MVPA across all age groups are low, and the majority of adolescents still do not meet the recommendations for physical activity.³ This is especially worrying, since in general, health behavior habits established in childhood tracks into adulthood.¹⁴

1.3 The setting

The Danish school system will be introduced briefly in the following section to allow the reader to gain a better understanding of the setting for the AAYR program.

Denmark has a population of a little over 5.5 million people,¹⁵ and is a welfare state with one of the highest levels of income equality in the world.¹⁶ Despite the social and economic conditions in Denmark being favorable, health inequality is still prominent among children and adults^{3, 17} and social inequality over the lifespan has increased since 1987.¹⁸

The school is a setting where all children can be reached regardless of their socioeconomic background⁴ which makes the school an important setting for health promotion, with the potential for health promoting programs to be implemented without further increasing inequality in health. In Denmark it is compulsory for children of 6 to 16 years to receive primary education.¹⁹ It is optional if the child attends public school (free), private school (with fees) or is home schooled.¹⁹ Denmark has 1.276 public and 551 private schools²⁰ located in 98 municipalities. 99,96% of all Danish children attend public or private schools.^{21, 22}

Danish school children mainly stay in the same classroom throughout the day where the teachers move from class to class (except for creative subjects and Physical Education). Each school class has a main teacher responsible for, among other things, ensuring a safe and engaging environment, corporation with parents, and coordination with other teachers. Further, this teacher has the responsibility for establishing social well-being in class.

The school curriculum is determined by the Danish Education Act.²³ Physical Education has its own curriculum to which around 60 to 90 minutes per week are assigned. The topic "health" does not have its own allocated subject, but "health, sexual education and family studies" must be integrated in the other mandatory subjects. Since 2014 it has been compulsory for each school to provide minimum 45 minutes of physical activity in each

school day.²⁴ This should always have a pedagogical aim, and can be offered either as class-room based physical activity (*CBPA*) (physically active lessons, curriculum focused active breaks, or active breaks)²⁵ or in corporation with the local sports clubs.²⁴ The responsibility of the implementation of this lies at the school management, however there are no resources allocated to the initiative and there are no consequences if it is not followed. The Danish Ministry of Education supports this structure by offering schools and municipalities inspiration to and knowledge of how to incorporate 45 minutes of physical activity in each school day, through education consultants.²⁶ The compulsory minimum of 45 minutes of physical activity in each school day is not implemented fully in Danish elementary schools.²⁷ In 2018, 24% of Danish teachers of school classes of lower school years, and 3% of teachers of higher school years implemented physical activity every day.²⁷ It is most often type of CBPA is "brain breaks" followed by curriculum focused active breaks.²⁷

Transportation to and from school in Denmark is usually done by walking, biking, by bus, or by car. Around half of all Danish school children bike to and from school, which is 20% less than in the beginning of the 90s.²⁸

1.4 School based physical activity programs

Numerous physical activity programs with different content, duration, and aims are implemented in schools across the world. In their Cochrane review, Dobbins et al²⁹ reviewed 44 studies of school-based physical activity programs. They found that all included programs differed on content, but similarities were that most programs had focused on increasing the students' knowledge of the benefits of an active lifestyle and on actually increasing time spent on physical activity at school. Such programs consisted of for instance student homework or workbooks about physical activity, teacher training sessions or manuals of how to incorporate physical activity in the teaching, or additional classroom-based physical activity or fitness sessions, physically active breaks. Further, many programs provided schools with educational material for the students, often together with educational sessions. Around half of the programs added community components by for example providing workshops for parents, and about one fourth of programs offered activities besides the school curricula, such as walkathons, game equipment, school fun nights etc. The types of

programs most likely to result in positive behavioral change were programs offering, at *a minimum*, a combination of educational materials, *as well as* changes to school curriculum where physical activity was promoted during school hours.²⁹

In Denmark, schools continually receive offers to participate in different local, regional or governmental health programs. One type of programs are nationwide campaign-based programs which are offered to Danish schools. For example, the "Get the school moving" program³⁰ which aims at increasing physical activity and healthy habits for students, and has been running for ten years with around 10.000 students participating in 2018. This program consists of videos to give inspiration to teachers of how to incorporate physical activity in the daily academic teaching, and activities for the students where they can develop their own ideas of ways to be physically active. Another program, "Active All Year Round" (AAYR)⁹ aims at contributing to healthy habits regarding physical activity, nutrition and sleep, with the main focus on physical activity. Today, the AAYR program is the physical activity program which covers most Danish students, with more than 350.000 or 52% of all Danish schoolchildren being signed up for the program in 2017. Another type of programs are programs targeted at whole communities. An example of such a program is the ongoing "Svendborg Project"³¹ initiated in 2007, a program consisting of tripling the amount of physical education in all elementary schools in a Danish municipality. This program has been found effective in terms of decreasing sedentary behavior during school time,³² reducing cardiovascular risk factors^{33, 34} and not negatively affecting the academic ability of students.³⁵ Further, facilitators of implementation were described by program managers to be early involvement of schools in program development, provision of a professional development course, predetermined core program elements though allowing adaption to the school contest.³⁶ Finally, several smaller-scale programs are testing new program approaches and are offered to only a few schools but are however very well evaluated. For example, the 2009 "SPACE for physical activity" program³⁷ consisted of 11 components regarding the physical environment (e.g. upgrade of the outdoor facilities for physical activity) and organizational structures of the school (e.g. physical activity policy, establishment of school play patrol). No effects on physical activity were found for this program.³⁷ The multi-component "Move for Well-being in School"³⁸ program from 2014 – 2017 aimed at improving psychosocial well-being for school children by providing competence development for teachers, educational materials, a school coordination group,

additional physical education classes, in-class activity breaks, recess activities, and student theme days focusing at well-being at school. A limited overall effect on student-perceived competence and self-worth was found.³⁹ Further, this program was studied regarding implementation, where it was found that there were large differences of implementation between schools, that implementation was stable throughout the school year, and that teacher perceived effectiveness of the program in term of increase student well-being was high.⁴⁰ The "We Act – together for health" program⁴¹ from 2015/2016 aimed at improving students' diet, physical activity, well-being and social capital, and consisted of an educational (e.g. students registering their physical activity by step counters), a parental (e.g. social media communication, handout to discuss eating habits with their children) and a school component (e.g. workshops for school staff and formation of a health committee). The program did not result in change in social capital, however it was found that student participation in the program affected the students' sense of belonging to the school negatively.⁴² The process evaluation revealed though that implementation fidelity was high for the introduction phases but low for the action and change phases of the program, hence little change happened at school.⁴¹

Thus, to some degree data has been provided on the implementation of smaller-scale programs, but not for larger nationwide campaigns.

1.5 The Active All Year Round Program

Since 2006, all Danish primary/elementary schools have been offered to sign up one or more of their school classes for the free campaign-based AAYR competition program.⁹ The program consists of three consecutive "health weeks". In 2016, the program was expanded to also include smaller one-day physical activity events offered throughout the year, in collaboration with the local sports clubs across Denmark. This thesis is based only on the three health weeks in 2015 (**paper I**) and 2017 (**papers II** and **III**). As the health weeks are by far the biggest part of the AAYR program, this evaluation uses the term "the AAYR program" for the dissertation.

AAYR is funded by the Danish Nordea Foundation and developed and conducted by University College South Denmark. I have conducted a process evaluation of the program and was not a part of the development or implementation of the program. At the outset, in order to get an understanding of the concept and rationale behind the program, I conducted individual interviews and several informal talks with the project leader of the program and his manager.

According to the developers of the AAYR program, the aim of the program is primarily to contribute to healthy habits regarding physical activity, nutrition and sleep, with the main focus on physical activity. The project's philosophy is to link healthy habits to fun, humorous and creative topics and therefore make it fun to be healthy, with the goal that students at all levels, develop healthier habits in a fun and "crazy" way. The development of the program was initiated by past experiences with a similar program in Norway and inspired by Banduras theory of self-efficacy.⁴³ Perceived self-efficacy is, according to Bandura, defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over event that affect their lives".⁴⁴ The AAYR program has been further developed and expanded over the years, based on the knowledge and experiences of the program developers as well as on yearly feedback from the participating teachers, through a quantitative nationwide survey.

For several reasons the AAYR program is seen as a health promotion program and not a program of disease prevention.⁴⁵ The AAYR program has a universal approach, where all schools in Denmark are able to join the program, and all students of the class can participate. Further, the program focuses on nutrition and sleep, but mainly on physical activity. These broad lifestyle activities can influence a broad range of behavioral outcomes from physical-to mental wellbeing. Finally, the program aims at contributing to healthy habits for children and adolescents. Thus, promoting health habits early in life. The Ottawa Charter for health promotion⁴⁶ identifies five priority actions for health promotion (building healthy public policy, create supportive environments for health, strengthen community action for health, develop personal skills, and re-orient health services) which can contribute to promoting the health of the population. The AAYR addresses two of these actions: to create supportive environments⁴⁶ (school setting being supportive of physical activity by implementing the AAYR program), and to develop personal skills⁴⁶ (enhancing skills of physical activity, through the AAYR program).

School teachers sign up their own school classes for the program. It is not determined by the program who is to implement the program in the school class. It can be the main teacher of the school class, the PE teacher or another teacher. The program consists of a number

of essential components, but beyond that offers every teacher the option to adjust the program to fit with his/her situation. The essential program components consist of; a small physical activity device for each student (e.g. a skipping rope in 2015 and a frisbee in 2017), a class poster which is to be used as a board game, and a student scorecard where students are to mark their daily healthy achievements they have performed either at home or at school (e.g. having eaten breakfast, having biked or walked to school, having used the frisbee at school etc.). The student scorecard is used to gather individual points for the daily health activities performed, adding to the chance of winning a class prize for being the "healthiest school class in Denmark". Further, teachers are provided with a set of teacher material consisting of ideas of how to use the physical activity device actively with the school class. These ideas consist of individual warm up exercises, pair-wise exercises and group exercises, like frisbee-golf or frisbee game of tag. In addition to these structured break activities, teachers, in the 2015 program, also received a small booklet of inspiration of how to use the physical activity device in combination with academic content (e.g. history, math etc.). Further, teachers can use between one and three program online videos with their school class: The core program video, which is a music video based on the theme of the year; a video showing only the choreography used in the main video (only 2017 program); and several video clips of tricks of how to use the physical activity device. Finally, teachers are provided with a guide which explains how to use the program in class, and an informational hand-out to the parents of the participating children. Illustrations of the essential components of the 2017 program can be found in appendix 1 and at the program webpage www.aktivaaretrundt.dk.

1.6 Outline of the thesis

Chapter 2 describes the theoretical framework used, followed by the aims and objectives of the thesis in *Chapter 3*. In *chapter 4*, the materials, methods, and results of the thesis are presented. *Chapter 5* presents the discussion of the results followed by strengths and limitations. In *Chapter 6* the main conclusions are presented together with the perspectives on and directions for future research.

Chapter 2 Theoretical framework

2. Theoretical framework

Using theory in implementation science can, according to Nilsen,⁴⁷ serve three purposes: to describe or guide the implementation process (process models), to understand and/or explain which factors influence implementation outcomes, and to evaluate implementation (evaluation frameworks).⁴⁷ The factors which can influence implementation outcomes are, according to Nilsen,⁴⁷ determinant frameworks, classic theories (theories which can be used to provide an understanding or explanation of aspects of implementation, but originating from fields outside of implementation science), and implementation theories. In the following, I have described the theoretical approaches used in this thesis: The Medical Research Council Framework⁴⁸ for conducting process evaluation studies, the classical theory of Diffusion of Innovations,⁴⁹ the evaluation framework of Linnan and Steckler,⁵⁰ the determinant frameworks of the socio ecological model,^{51, 52} and the ecological framework of Durlak and Dupre.⁵³

2.1 Framework to guide the study of implementation

Process models serve the purpose of describing or guiding the implementation process - of how to translate research into practice.⁴⁷ As the AAYR program had already been developed, in this thesis I have not used a process model. Instead the Medical Research Council's Framework (*MRC*)⁴⁸ for conducting process evaluation studies was used as a reference since this framework provides guidance as to how to conduct and report process evaluation studies, and not about how to implement studies. The latest version of the MRC framework has extended the focus from a medical context to including examples of how the framework can be utilized studying school-based health promotion programs.⁴⁸ Thus, like other authors of conducting studies about implementation of school-based physical activity programs,^{40, 41, 54} I found it advantageous to use this framework in a health promotion context.

The MRC framework identifies the key components of a process evaluation to be: implementation, mechanisms, and context.⁴⁸ Exploring the step between implementation and effects – the mechanisms of how the program produces change, is out of the scope of this thesis, since the focus of this thesis is on implementation and not program effects. Hence, I have included the components of implementation and context only. In developing

and planning this process evaluation, the four key recommendations of planning, designing and conducting, an, and reporting as suggested by the framework⁴⁸ were followed.

2.1.1 Program theory

The MRC's framework⁴⁸ suggests that a clear description of the intended program, how it will be implemented, and how it is expected to work, will ideally have been developed before program implementation. The AAYR program has been developed on the basis of practice and without an explicitly formulated theory of change, thus no such explicit model had been developed before the program was introduced. The MRC's Framework⁴⁸ acknowledges that while causal assumptions in program development should be drawn from theory, programs are often also informed by other factors such as previous experience. This is the case for the AAYR program as it is mainly based on previous experiences in health promotion practices (see chapter 1.5). However, inspiration was drawn from Social Cognitive Theory (*SCT*).⁵⁵ Also, the core assumed effect mechanisms of the program are clearly in line with the Theory of Reasoned Action/Theory of Planned Behavior (*TRA/TPB*).⁵⁶ Both the SCT and TRA/TPB have often been used in behavior change programs for children,⁵⁷⁻⁶³ which makes both theories relevant to apply to a school based program like the AAYR which targets children's health behavior.⁹

To gain a better understanding of the program, I have therefore post-hoc analyzed the AAYR program using SCT⁵⁵ and thereafter the TRA/TPB,⁵⁶ and related these theoretical approaches to existing research.

The key constructs of SCT are: a) knowledge of health risks and benefits, b) perceived selfefficacy that one can control one's own health habits, c) outcome expectations regarding expected costs and benefits for health habits, d) health goals people set and concrete plans for realizing them, and e) perceived facilitators and social and structural barriers to the change they seek to accomplish.⁵⁵ According to SCT, all key constructs influence motivation and behavior.⁵⁵ I have identified the behavior change techniques of the AAYR program that align with the two most important constructs of the SCT: self-efficacy and outcome expectations.⁶⁴ Thus, not all elements of the theory are applied to the AAYR program, but only the core components of the model.

One of these components are outcome expectations.⁵⁵ Outcome expectations are the expected costs and benefits people perceive in regard to different health habits, and according to SCT, health behavior is affected by the outcomes people believe their actions produce.⁵⁵ The underlying principle of the AAYR program is that it should be fun to be healthy.⁹ Thus, it is anticipated that children, through the new experience that being physically active is fun, can raise their positive outcome expectations about physical activity in the future, whereby their physical activity behavior is influenced in a positive way. Previous research has indeed identified outcome expectations to explain substantial variance in adolescents' physical activity intentions and behavior.⁶⁰

The other core component of SCT is self-efficacy.⁵⁵ Self-efficacy is the belief a person has in his/her own abilities to perform specific behaviors or accomplishing a task successfully.⁵⁵ The AAYR program attempts to influence students' perceived self-efficacy in different ways. The program's physical activity exercises are designed in a very simple way and are easy to perform. This should enable all students to experience success in performing them and thereby enable the students to believe that they can perform the required actions. Successful learning is further facilitated by social modeling,⁶⁵ in that these easy exercises are demonstrated to the students by the teachers and further by students learning the behavior by observing their peers conducting the program exercises. These mechanisms should enable the students experience of success in performing the required physical activity exercises. One of the learning mechanisms posited by SCT is learning by doing.⁴³ Thus, through enactive attainment students should raise their levels of self-efficacy.⁵⁵ This link is empirically supported by research, where it is well established that self-efficacy is an important variable linked to physical activity behavior change in children and adolescents.^{60,} ^{64, 66}

Further, it is relevant to analyze the program from the perspective of another theory which also focusses on the social foundations of social learning⁶⁴ - the Theory of Reasoned Action/Theory of Planned Behavior (*TRA/TPB*).⁵⁶ According to the TRA/TPB⁵⁶ behavior is determined by personal as well as by social beliefs about the behavior. Both are in fact equally important in shaping behavioral intentions and actual behavior change. Both theories state that a central factor explaining people's behavior are *attitudes*.⁵⁶ The philosophy of the AAYR program is to make it fun to act healthily, i.e. to be physically active⁹ and thus the

program indeed has its focus on the creation of positive attitudes based on immediate enjoyment rather than athletic achievements or longer-term health goals. Through students experiencing having fun while performing the physical activity exercises, they should develop positive feelings about physical activity. In analyzing the AAYR program from the perspective of the TRA/TPB,⁵⁶ this "fun" element of the program can be viewed as the emotional evaluation of the behavior. Thus, students should form positive attitudes towards physical activity because they are experiencing having fun while being physically active. Such general positive attitudes should, according to the TRA/RPB,⁵⁶ shape the students' behavioral intentions and actual physical activity behavior.

Further, in using the AAYR program, all children in the school class are physically active together and they have a common goal. This common context should, according to the TRA/TPB,⁵⁶ favorably influence students' subjective norms with regards to physical activity, which should also shape the students' behavioral intentions and actual physical activity behavior. Sound empirical evidence has accumulated over the years⁶⁰⁻⁶³ which has confirmed a link between the concepts of the TRA/TPB and physical activity behavior in adolescents.

2.2 The importance of studying implementation

In the 1960s, Rogers⁴⁹ introduced his theory of Diffusion of Innovations. According to this theory, people go through five stages of decisions before fully adopting an innovation or program. These are the stages of knowledge, persuasion, decision, implementation, and confirmation.⁶⁷ The fourth stage - implementation - is where the program is effectuated. My research covers this phase of the diffusion process, which is relevant as this is where the teachers adopt the program. There is great diversity of the perspectives of what constitutes implementation.⁶⁸⁻⁷¹ This thesis uses the definition of implementation as presented in the MRC framework as *"the process through which interventions are delivered, and what is delivered in practice"*⁴⁸ (p. 8). It should be emphasized that where **papers II** and **III** clearly focuses on implementation, in **paper I** the focus is on teacher perceived effectiveness (*TPE*), which is often included in process or program implementation. TPE measured several months after program completion would certainly reflect effectiveness. However, TPE

measured immediately after program completion (as done for this thesis, **paper I**) may rather reflect problems during implementation rather than true effectiveness.

Assessing implementation is important, because this can reveal if lack of effects or smaller than expected effects of a program are rooted in program failure or are due to the program not being adequately implemented.^{10, 74} Implementation rarely develops as intended^{53, 75} as complex processes surrounds programs in real-life situations. This stresses the need for studying implementation to reveal if the program was implemented as planned or not.⁷⁵⁻⁷⁹ However, research still tends to focus exclusively on the effectiveness of programs and not on the implementation, or as Naylor et. al⁷⁴ concluded: *"The study of implementation of school-based physical activity interventions is in its infancy"* (p. 113).

2.3 Measuring implementation

Measuring implementation is acknowledged to be complex^{75, 78, 80} and inconsistencies exist in the way implementation is defined and measured.^{53, 69, 75, 81, 82} For example, Dusenbury et al.⁸³ measured implementation through observation of adherence, the quality of process, and adaption, where Dane & Schneider⁸⁴ in their review identified research to be utilizing between one and five of the dimensions; adherence, exposure, quality of delivery, participant responsiveness and program differentiation. However, implementation is often measured using only one or two dimensions,^{69, 80} which is often dose, adoption, or fidelity.^{10, ⁸⁵ However, it is widely recommended to study more dimensions of implementation^{53, 75, 80, ⁸¹ as each dimension can be distributed differently and can be of different importance for the outcome measured. Further, this can establish a more comprehensive picture of the implementation of the program.^{75, 84}}}

I have focused on the multiple dimensions of implementation of; reach, dose delivered, dose received, and fidelity, which are key process evaluation concepts in the evaluation framework by Linnan and Steckler.⁵⁰ Reach is often defined as the percentage of the target group participating in the program.⁵⁰ However, as participation in school-based programs, to a large extent, is a given based on presence or absence in class,²⁹ in this thesis reach is studied as a psychological component in term of student engagement (se chapter 4.5.1.3 for at further elaboration of this issue).

I conform to Linnan & Steckler's understanding that implementation can be operationalized by applying a composite score "... that indicates the extent to which the intervention has been implemented and received by the intended audience"^{50 (p. 12)}. Using a composite score has the advantage that since studying more dimensions of implementation is found favorable,^{53, 80, 81, 83} thus combining these to a composite score of implementation is expected to give a more thorough measure of implementation. Further, the main focus of this thesis is on context factors, and not on exploring the reach, dose, or fidelity of the AYR program, nor on revealing which implementation components showed a stronger or weaker association with contextual factors. Linnan and Steckler⁵⁰ recommend that process evaluations collect data to determine the context as well as the four above mentioned dimensions of implementation as a minimum.⁵⁰ Further, they suggest to include the concept of recruitment as proposed by Baranowski and Stables.⁸⁶ This concept is, however not included in this thesis. When the AAYR program was initiated in 2006, many efforts were used to advertise the program. However, the program is now extremely well known in Denmark, thus recruitment is solely done by sending out e-mails to school principals and prior participants (teachers) of the program. Thereby, teachers who have not been participating in the program in previous years, are not actively pursued for potential program participation. Further, as the program is offered nationwide, the resources needed to examine which types of schools/teachers did not sign up for the program, would have been immense. Assessing recruitment therefore was deemed non-feasible - at the same time also seemed less relevant in comparison to other criteria. Further, Linnan and Steckler⁵⁰ maintained that context is essential to include in a process evaluation, as an understanding of context is important in order to know which environmental factors might have influenced implementation. The understanding of social context used for this thesis is described in the following.

2.4 Contextual factors affecting implementation of physical activity programs

It has been established that effective implementation is essential for evidence-based programs to lead to improved outcomes.¹⁰ However, this led me to wonder, which contextual factors then affect implementation?

The thesis is based on the socio-ecological perspective^{51, 52} where the view is that behavior is determined by complex interactions between individual factors (e.g. gender, attitudes) and

the physical (e.g. facilities and availability of equipment), social (e.g. peers, teachers, family), and policy environment. In contrast to behavioral models, ecological models explicitly consider not only individual skills and characteristic to influence health behavior, but also the influence of the broader environment⁵². Socio ecological models are often used in the development of programs, by incorporating multi-level components to the program to change health behavior.⁵² In this thesis the socio-ecological perspective has not been used to guide program development, but on the perspective on implementation. Thus, program implementation is viewed here as not only relying on the content and quality of the program itself, or to be determined by the behavior, skills and characteristics of the teachers and students, but implementation is also believed influenced by the social context of the school, such as the policies of the school, managerial support, school size, and school physical environment for physical activity. Further, prior research has acknowledged that health promotion programs depend on the context.^{87, 88} This perspective of different levels of contextual factors affecting behavior is important in studies in a school setting, as higherlevel factors (e.g. policy environment) can enable change in lower level factors (e.g. student attitudes) at the model. This thesis uses the definition of context by Linnan and Steckler⁵⁰ of "Aspects of the larger social, political, and economic environment that may influence intervention implementation" (p. 12). To narrow the scope, I have included two groups of contextual factors: school context factors and target group characteristics (including facilitators and barriers for implementation).

2.4.1 School context factors

The importance of uncovering the effects of contextual factors on implementation has frequently been emphasized.^{79, 89-92} In the determinant framework of Durlak and Dupre,⁵³ five domains were identified to affect implementation of school-based programs in general: Community level factors, provider characteristics, characteristics of the innovation, factors relevant to the prevention delivery system (e.g. organizational factors, specific practices and processes, and staffing considerations), and factors related to the prevention support system (e.g. training and technical assistance). In the specific area of school-based physical activity programs, Naylor et al.⁷⁴ identified 22 factors of being either facilitators and/or barriers of implementation. The majority of factors discovered, fell into the categories recognized by Durlak and Dupre,⁵³ though, in addition, Naylor et al.⁷⁴ found time to be the factor most often identified as a barrier for implementation. Further, specifically related to

physical activity programs, the school context factor of lesson scheduling was found to be a barrier of implementation. A recent review on facilitators and barriers of implementing classroom-based movement integration⁹³ found similar types of factors to be facilitators of implementation: administrative support and availability of resources, where barriers of implementation were identified to be lack of time, resources, space, and administrative support. In a Danish setting, the following context factors have been found to be facilitating implementation: the establishment of organizational support for the program, the initial interest of the school,³¹ and program flexibility enabling adaptation to the local context.³⁶ A strong focus on the competition element has been found to be a barrier, since students' experienced peers to express limited tolerance and understanding of differences in capabilities to conduct program activities, which lead to conflict.⁹⁴

2.4.2 Target group characteristics

Implementation of physical activity programs naturally involves, to a large extent, the target group – that is the students themselves in school-based programs. However, few studies have explored the relationship between target group characteristics and implementation. The determinant framework of Durlak and Dupre⁵³ referred to above, did not include target group characteristics, and in the review by Naylor et al,⁷⁴ of 22 factors identified to affect implementation, only two were related to the student target group. These two categories covered the aspects of: student engagement/motivation, ethnicity, disruptive behavior and misbehavior.⁷⁴ In studying effectiveness of school-based physical activity programs, for instance higher relatedness (i.e. students' relationship with peers and teachers) was found to be related to higher student perceived effectiveness in terms of well-being at school⁹⁴ of the physical activity program "Move for Well-being in School". This indicates that different groups of students may profit differently from physical activity programs. The question is, whether this differentiation exists already at the implementation level?

Thus, as presented above, some evidence of which school context factors and target groups characteristics influence implementation of school-based physical activity programs does exist. However, little is known about which contextual factors influence the implementation of particular type of programs which are based on a competition approach, where school classes compete for prizes linked to the achievement of behavioural goals. It may not be expected that short term programs such as competitions can change complex behaviour

patterns such as physical inactivity alone. However, by introducing a "fun element", such programs may contribute to creating positive attitudes towards physical activity among the students. This may help reduce psychological barriers of students who might otherwise avoid participating in such activities due to a negative mindset towards physical activity, as it has been reported by previous research that class competitions may appeal specifically to inactive students who would usually not get involved in physical activity programs.⁹⁵

This PhD thesis attempted to contribute to the above described research area, using the established competition based physical activity program "Active All Year Round", as an example.

2.5 Logic model

The Medical Research framework⁴⁸ recommends depicting the program which is to be evaluated, in a logic model to help clarify causal assumption. Thus, I have developed a posthoc logic model⁹⁶ of the AAYR program depicted below (Figure 2). The development of this model is based on the analysis above of the AAYR program from a theoretical perspective, as well as the existing research on school context factors and target group characteristics. The logic model summarizes and portrays the different aspects of the program, as described earlier, and establishes a link between the causal assumptions underlying the program.



Figure 2: Logic model of the AAYR program

A program goes through a minimum of three stages of development; the planning stage, the implementation stage, and the effects stage.⁹⁷ The AAYR program is in a late stage of development, since it was running for the 12th time in 2017. It has been adjusted continuously but has left the actual planning stage. This PhD thesis has prioritized the most important element of these three stages of development to be the implementation stage, thus the development and effect stages are out of scope for this thesis. Therefore, in the logic model, the inputs and outcomes are only described by the logic model but are not analyzed in the thesis (see figure 2). In the implementation stage, the process evaluation seeks to reveal real program activities as opposed to ideal activities.⁹⁶ The results could lead to improvement of the activities in the program.⁹⁷ In the effect stage, an evaluation would seek to reveal both intended and unintended effects of the program.⁹⁷ In the logic model I have portrayed the short-term, intermediate and long term outcomes the program could anticipate, as outcomes are often expected to unfold over time.⁹⁸ To achieve the goal of the AAYR program that students at all levels get healthier habits in a fun and "crazy" way, several steps are anticipated to facilitate change in habits. As described previously, based on the Social Cognitive Theory,⁵⁵ Theory of Reasoned Action/Theory of Planned Behavior,⁵⁶ and backed up by empirical findings,60,66 short term outcomes for participating students could be expected to be a change in behavior directly (intermediate outcome) (in this case physical activity behavior), or a change in attitudes towards physical activity (short term outcome) which can lead to a change in physical activity behavior. Finally, it is well established in the literature,⁹⁹ that an increase in physical activity levels, can lead to improved well-being and a reduction in chronic diseases (long-term outcomes). The implementation of program activities is, based on existing research presented in chapters 2.4.1 and 2.4.2, expected to be influenced by target group^{74, 94} and school-level context factors.^{31, 36, 53, 74, 93, 94} Following the socio-ecological perspective^{51, 52} behavior is determined by complex interactions between individual and social factors. Thus, a possible link between target group and school-level context factors and changes in students' physical activity behavior is hypothesized, but not studied in this thesis. Further, seen from the socioecological perspective^{51, 52} behavior is also determined by the physical environment, such as the area one is living in, absence/presence of parks, walking trails, sidewalks, bike trails etc.⁵² Based on this, the availability and access to settings for physical activity is

hypothesized to possibly influence changes in students' physical activity behavior, though this aspect is out of scope for this thesis.

The above described logic model is developed for the reader to better understand the link between the causal assumptions underlying the program. However, it should be emphasized that this thesis does not include the "outcomes" part of the logic model, as this would require an effect evaluation which is out of scope of this thesis.

2.6 Summary

The preceding chapter has presented different concepts of key process evaluation components used in this thesis. In sum, and based on the before mentioned theoretical foundations, two groups of contextual factors are included in this thesis: school context factors and target group characteristics (including facilitators and barriers for implementation). These factors are anticipated to influence implementation of the AAYR program in terms of level of implementation and teacher perceived effectiveness.

To sum up the concepts used in this thesis, and their definitions, these are presented in table 1.

Concept	Definition
Context	"Aspects of the larger social, political, and economic environment that may influence intervention implementation" ^{50, p. 12}
Reach	The participants' attitudes towards and engagement in the program, own definition
Dose delivered	"The number or amount of intended units of each intervention or each component delivered or provided. Dose delivered is a function of efforts of the intervention providers" ^{50 p. 12}
Dose received	The extent to which the participants actively participate in the program activities, own definition inspired by Linnan and Steckler ⁵⁰ .
Fidelity	"The extent to which the intervention was delivered as planned. It represents the quality and integrity of the intervention as conceived by the developers. Fidelity is a function of the intervention providers." ^{50, p. 12}
Implementation	"Includes a combination of reach (who participated), dose (what the program delivered), dose received (what participants received), and fidelity (the quality of the intervention delivered)."50, p. 14
Teacher perceived effectiveness	Teachers' perceptions of the degree to which the program influenced the students' attitudes towards and levels of physical activity, own definition

Table 1 [.] Concer	nts and definitions	s of key process	evaluation com	nonents
Table 1. Concep	pis and deminions	s of key process	evaluation con	iponenio

In the next chapter the specific research objectives will be presented followed by the logic model of the thesis.
Chapter 3 Research objectives

3. Research objectives

The overall aim of this thesis has been to investigate what affects the implementation of a school-based physical activity program in order to optimize future program development and implementation. This could be beneficial for both program developers, implementation research, school staff, students at teacher education programs, and the children who are intended to benefit from the program. The thesis seeks to accomplish this overall aim by conducting a process evaluation of the "Active All Year Round" program.

The specific purpose of this thesis has been to investigate whether, and if so, which aspects of social context and target group characteristics affect implementation as well as teacherperceived effectiveness of the "Active All Year Round" program. The specific objectives of the thesis were to examine:

- Do school social context factors affect teacher-perceived effectiveness of the program?
- How do teachers perceive the feasibility of program implementation as well as implementation barriers, program reach and the programs' influence on social cohesion?
- Do student level and school level context factors affect level of program implementation?

The three papers included in this thesis contributes to the overall aim and specific objectives stated above, in this way:

Paper I, a cross-sectional questionnaire survey, contributed to the overall aim of the thesis by investigating if school social context factors modify *teacher perceived* effectiveness of the AAYR program, in terms of perceived positive changes in physical activity levels and attitudes towards physical activity in the participating students. The paper is based on data from school-teachers nationwide who had implemented the AAYR program in any school grade in 2015. Thus, this paper includes school social context factors, and mainly contributes to the first objective of the thesis.

The **second paper** has contributed with a qualitative analysis of several aspects of the AAYR program, as experienced by 16 teachers who had implemented the 2017 program in their fifth-grade school class. Teachers' experiences of the feasibility and barriers of program implementation, perceptions of program reach in terms of students' active participation and

engagement, as well as perceptions of the programs' influence on social cohesion were analyzed, to gain a deeper understanding of *how* program implementation may be influenced by the school context and target group characteristics. This paper mainly contributes to the second objective of the thesis and is further intended to support a better understanding and interpretation of the results of **paper III**.

The aim of the **third paper** was to analyze whether student- and school-level context factors affect level of program implementation. Data was gathered from 16 teachers who had implemented the 2017 program in their fifth-grade school class, the students from these 16 school classes, in-class observations and register data. Thus, this paper includes student-as well as school-level context factors, and mainly contributes to the third objective of the thesis.

In the MRC framework⁴⁸ it is recommended that, in order to maintain an overview of the broader picture, articles which are a part of a broader study should refer to each other. Accordingly, in **papers II** and **III** I have explained that the papers are a part of a broader study, referred to as "Physical Activity Competition Evaluation – Denmark" (*PACE – Denmark*) (i.e. this PhD project).

Chapter 4 Materials, methods and results

4. Materials, methods and results

The following chapters will give an overview of the aims, data sources and methods used for the three included papers, the timeline for the program weeks and times of data collection, as well as an introduction to the way the multimethod design¹⁰⁰ has been used in this thesis. Due to the differences in methods used in the different sub-studies, the materials, methods and results of **paper I** will be presented first, followed by the materials, methods and results of **papers II** and **III**, respectively.

4.1 Overview

This PhD thesis consists of three original empirical studies based on data from the Active All Year Round program. **Paper I** was based on data from a nation-wide cross-sectional teacher survey in 2015. **Papers II** and **III** were based on the 2017 AAYR program and included data from 16 selected schools. For **paper II**, data came from a qualitative study of teachers and **paper III** was based on a combination of a teacher survey, student survey, inclass observations and register data. Table 2 presents an overview of the aims, data sources and methods used in **papers I** to **III**.

	Paper I	Paper II	Paper III
Aim	To examine if teacher- perceived effectiveness of the program varies as a function of school social context factors	To investigate teacher- perceived feasibility and barriers of implementation of the program, program reach and the programs' influence on social cohesion	To examine if student- and school level context factors affect level of program implementation
Data source	Teachers (n = 2.097)	Teachers (n = 16)	Teachers (n = 16) Fifth grade students (9-11 years) (n = 276) In-class observations (n = 15) National register
Study design	Cross-sectional questionnaire survey	Semi structured individual interviews	Process evaluation of an intervention program
Data analysis	Multi-variable logistic regression	Systematic text condensation	Multilevel linear regression
Study period	October to November 2015	November to December 2017	September to December 2017

Table 2: Overview of aims, data sources and methods for paper I - III

For **papers II** and **III**, data were collected at different timepoints around the 2017 program. The timeline of program weeks and data collection for **papers II** and **III** can be found in figure 3.



Figure 3: Timeline of program weeks and data collection

4.2 Multimethod design

Creswell¹⁰¹ has suggested a "philosophy of pragmatism" discarding the position between the two opposing viewpoints of qualitative versus quantitative methods. Thus, the choice of research methods should be determined by what the most effective way to answer the research question is.¹⁰¹ In this PhD, this paradigm led me to use both qualitative (**paper II**) and quantitative methods (**papers I** and **II**) to pursue the overall aim of the thesis.

A multimethod design¹⁰⁰ was applied for this thesis. The overall aim has guided three interrelated sub-studies that are conducted by different methods for data collection, which is what constitutes a multimethod design.¹⁰⁰ Employing multiple methods for data collection is recommended in implementation research as different methods of data collection can fit in with the different requirements and constraints of the specific program and can lead to different conclusions.^{48, 102, 103} Further, using both methods are often done in process evaluations as this gives more rich details of program implementation.⁵⁰

It can be discussed, if including two quantitative papers and one qualitative paper in a PhD thesis would constitute a multimethod or a mixed methods approach. Very different

perspectives exit as to what constitutes a mixed methods study.¹⁰⁴ Johnson, Onwuegbuzie and Turner¹⁰⁴ asked prominent proponents of mixed methods research how they would define mixed methods research and found that it is widely acknowledged that mixed methods include the mixing of quantitative and qualitative methods. However, great differences in opinions occur as to when the mixing should be carried out (in the data collections stage, the data analysis stage or perhaps at all stages of research) as well as the breadth of mixed research (e.g. if the mixing of methods should also occur in interpretations and knowledge dissemination). This thesis adheres the understanding that a mixed methods design incorporates both qualitative and quantitative methods at data collection and analysis within a single study (se for instance Morse¹⁰⁰). Thus, following this understanding this thesis has not used mixed methods, since different methods are not used within sub-studies but across different sub-studies. It could still be argued though that a mixed methods approach is used, since results from the three sub studies are combined in this thesis. However, it was judged that the degree of integration of the qualitative and quantitative results in this thesis is not done to an extent which can justify that I have used mixed methods.

In the two quantitative papers (**papers I** and **III**) the theoretical base established by literature and previous research (presented earlier) have been used to test assumptions of associations between context factors and implementation or teacher-perceived program effectiveness. For **paper two** the qualitative method was used, since a quantitively study of this sub component of teacher-perceived program feasibility would not be able to provide the thorough and rich description of this phenomenon which I was interested to uncover.

Thus, in this multimethod design,¹⁰⁰ qualitative and quantitative data was not integrated within each paper, but each of the three sub-studies were rather conducted independently to answer each of three individual research questions. For **papers II** and **III**, a simultaneous design¹⁰⁰ was used, where qualitative and quantitative data were gathered at approximately the same time. In this thesis, most focus is given to the quantitative method; hence a "QUAN + qual design"¹⁰⁰ is used.

In the paragraphs below, the methods and results of the three papers will be presented.

4.3 Paper I

After the 2015 AAYR program I conducted a cross-sectional nationwide questionnaire survey to examine if teacher-perceived effectiveness of the program varies as a function of school social context factors. The results of this study are reported in the published article: *"Physical activity school intervention: context matters"*.¹⁰⁵ The materials and methods used will be presented below, followed by the results of the study. For a more detailed description about the scales used and collapsing of response categories, see **paper I**.

4.3.1 Materials and methods

4.3.1.1 Data collection

Each year after the AAYR program ends, the institution which runs the AAYR program (UC South) distributes a questionnaire to all teachers nationwide who had signed up their school class for the program. This questionnaire holds different questions as to get initial feedback on teachers experiences of the program, how useful they found the different program components, if they would like to participate next year etc. Data collection for **paper I** was a minor part of this bigger survey, which was conducted from October to November 2015.

The questions were newly developed for the present study. Independent or exposure variables included characteristics of *the school* (school size, physical activity policy, prioritization of health promotion, teachers' satisfaction with school physical environment), *the teachers* (prior participation in the AAYR program, support from school principal), *the school class* (school year), and *the students* (immigration background, parental education level, parental employment status). Outcome variables were teacher perceived effectiveness of the program as determined by teachers' perceptions of changes in children's *attitudes towards* and *levels of* physical activity after program participation. See **paper I** for the specific questions included.

4.3.1.2 Data analysis

Data were analyzed with the help of IBM-SPSS for Windows v. 23. Data were collected via the electronic system SurveyXact and imported to SPSS, where it was checked for errors by descriptive statistics including frequency distributions.

Data were first analyzed descriptively by presenting frequencies of the independent variables. Further, to determine bi-variate associations between the independent variables

and possible changes in students' attitudes towards and levels of physical activity, *P*-values and chi-square (χ^2) tests were applied. To determine the independent contributions of the different independent variables on the outcome variables, multi-variable analyses were performed by applying hierarchical logistic regression, to adjust for the potential confounders. The main variables of interest were: schools' physical activity policy, schools' prioritization of health promotion, teachers' satisfaction with the support they received from their principal implementing the program, and satisfaction with the physical environment of the school for physical activity. These variables were therefore entered to the statistical model in the second step (model 2) of the analysis, while school size, school year, teachers prior program participation, student immigration background, parental education level, and parental employment status had been entered in step one (model 1).

4.3.1.3 Ethical considerations

According to the Act on a Biomedical Research Ethics Committee System in Denmark, the project was not a biomedical research project and therefore did not need the ethic committee's approval. All teachers were informed that their participation in the study was voluntary and that their responses would be anonymized.

4.3.2 Results

The survey was distributed to all teachers (n = 5.892) who had signed up their school class (all grades, ages 5 – 17) for the 2015 AAYR program and was completed by 2.097 teachers (response rate 36%). 64 of the questionnaires were excluded retrospectively, since teachers had only answered between one and nine of the initial background questions. Further, to achieve a homogeneous sample size across the different analyses, 252 questionnaires were excluded since teachers had felt unable to answer one or more of the questions about children's socio-economic background (parental unemployment and educational background) by choosing the "don't know"-answer option. Thus, 1.781 questionnaires were included in the data analysis. The descriptive analysis revealed that 61% of teachers reported a positive change in children's attitudes towards physical activity and 65% reported a positive change in physical activity levels of the students, after participation in the AAYR program.

The bi-variate analysis showed that there was a consistent difference in changes in attitudes towards and level of physical activity depending on: lower school year, educational

background of the parents of the participating children, schools having a policy for physical activity, schools prioritizing health promotion to a higher degree, higher teacher satisfaction with school physical environment and teachers being satisfied with the support they received from their school principal in implementing the AAYR program.

Multi-variable analyses revealed that the odds of teachers reporting a positive change in attitudes towards physical activity of the students, were higher for teachers of classes where 41 to 80% of the parents of the children came from a higher educational background, and for teachers who had participated with groups of younger students (ages 5 - 11). The odds of reporting a positive change in level of physical activity of the school children were lower for teachers with low (compared to high) satisfaction with the schools' physical environment. Further, teachers from schools prioritizing health promotion to a high degree (compared to low to medium) were more likely to report favorable change in attitudes towards physical activity and increased level of physical activity of participating children. Finally, teachers not satisfied with the support they received for the program from their school principal, were less likely to report a positive change in attitudes towards physical activity.

4.4 Paper II

To investigate teacher-perceived feasibility and barriers of implementation of the program, program reach and the programs' influence on social cohesion a study was conducted based on individual interviews with teachers who had implemented the AAYR program in 2017. The results of the study are presented in the published article titled "Program Reach and Implementation Feasibility of a Physical Activity School Health Program: A qualitative study of teachers' perception".¹⁰⁶

When designing this PhD, the initial idea was to use a deductive approach¹⁰⁷ for this qualitative study and identify which barriers and facilitators the teachers perceived to influence program implementation, and how they influenced implementation. At the initiation of the PhD I performed in-class pilot observations in three school classes while they used the 2015 AAYR program, and I conducted interviews with teachers of each of these classes. From these observations and interviews it became clear that teachers found the program to be easy to work with and expressed very positive attitudes towards the program. Thus, solely focusing on perceived barriers and facilitators of implementation for my second paper

was too limited. Therefore, it was decided to change my research objective and approach for this study and ask teachers more openly about program implementation and move away from the deductive approach.

The following chapter will present the materials and methods used, followed by the results of the second study.

4.4.1 Materials and methods

4.4.1.1 Data collection

Semi structured individual interviews were conducted with 16 teachers who had implemented the program in their fifth-grade (9-11 years old) school class. Emails were sent to the school principal, to ask for permission to contact the teachers. School enrollment was identical to that used for **paper III** and will be presented in the methods description for this paper. The interviews took place at the school and took approximately 30 - 60 minutes to conduct.

I developed a semi-structured interview guide which focused on the teachers' experiences in program implementation, their views on the students' participation in the program, and possible influence on social cohesion. Social cohesion has been defined in many different ways.¹⁰⁸ This thesis adheres to Bollen & Hoyle's¹⁰⁹ perspective that social cohesion or perceived cohesion can be defined in this way: "Perceived cohesion encompasses an individual's sense of belonging to a particular group and his or her feelings of morale associated with membership in the group".¹⁰⁹ (p. 482)

The interview guide was adjusted after each conducted interview, if new themes of importance for the research objective emerged.

Interviews were conducted after the three program weeks, to be able to include the teachers' views based on the complete program from beginning to end. In order to execute the interviews as shortly after the end of the program as possible, thus ensuring that the teachers could remember their experiences, interviews were conducted by three people including me. I have a longer standing experience in interviewing, from my undergraduate and post graduate training, as well as from previous job contexts. The two other interviewers had experience in interviewing from their undergraduate training, and to further prepare

them for the interview sessions, they performed a practice interview with me, where I guided them and gave them feedback on their interview skills.

4.4.1.2 Data analysis

The study draws on the phenomenological approach with a focus on subjectivity and on the experiences and meanings attributed by the studied subjects.¹¹⁰ In the interview situation as well as in the analysis of data, I attempted to keep an open mind by putting my preconceived assumptions about the implementation of the program and the work situation of the teachers aside.

I was interested in capturing not only what the participants said, but also how it was said, and under which circumstances. Therefore, data were transcribed true verbatim, where sounds and non-verbal communication were noted down as they were judged to be of relevance for the interview. Further, to enable consistent transcription and to reduce mistakes, I developed a transcription codebook¹¹¹ which was followed for the transcription for all interviews (see appendix 2). The software program NVivo 11 was used in the data analyses process, and data were analyzed by systematic text condensation¹¹² (*STC*). According to Malterud,¹¹² STC emerged from Giorgi's psychological phenomenological analysis and serves as a pragmatic procedure of qualitative data analysis. Using STC allowed me to extract the most prominent domains of my findings through five structured steps. Table 3 illustrates an example of how the coding was conducted over three of the stages.

Theme	Meaning units from interviews	Code
Time constraints	Timewise I needed to do some of the things I was working on, instead of adding something completely new. And yes, I could have said that, now we will just go down and have fun and do some of these exercises. I just didn't think we had the time for that. Also, because we had another campaign which overlappedsome theatre and something like that. So, we needed to make it all fit together.	Work- and time pressure
Time constraints	We are in a situation where we have very limited preparation time. And yes, it is annoying, but we talk a lot about time. And I must say that I have a greater need of preparing the academic content[] so I would say that my time should be used on something else, at least if I am going to have time for everything, unfortunately.	Work- and time pressure

Table 3: Example of coding

First, I read all transcripts through, got familiar with the material, and formed the initial themes which emerged from the data. In accordance with STC, I kept an open mind in this stage of analysis and tried to bracket any preconceptions by noting down my preconceptions, reflections and beliefs before analyzing the data. The purpose of this procedure was to enable me to be conscious of the voices of the subjects (teachers). Further, to avoid favoring meaning units which supported any preconceptions during the data analysis, I revisited these notes several times to reflect upon any preconceptions in relation to the data analysis.

I identified several themes at this stage of analysis and, for further analysis, gave priority to five of these which were the most prominent domains of our findings (see example in table 3). Hereafter, I systematically re-read each transcript line by line, to identify the parts of the text which contained information about my research question – the meaning units (see table 3). These meaning units were further grouped in several codes (see table 3). Together with my supervisors, we checked the emerged codes against the data, and agreed upon the content and labels of the codes. Then, I reconceptualized the data, by assessing findings against the wholeness of the material. Finally, headlines were established for the phenomena which emerged from the analysis and illustrative quotations were chosen to reflect these phenomena. In appendix 3, a concept map illustrating an example of how the qualitative data was analyzed, can be found. This concept map illustrates one of the themes (program feasibility) and has been developed with the help of the program NVivo 11.

4.4.1.3 Ethical considerations

The study adheres to Danish standards for ethical conduct of scientific studies. All teachers were informed that data would be presented in a completely anonymized form. Teachers were informed that their participation was voluntary and gave oral consent.

4.4.2 Results

More than half of the interviewed teachers were women and most teachers had more than 10 years of teaching experience. The majority had participated in the AAYR program before and in other health programs for school children, and less than half had further education about physical activity. All teachers taught the participating school class in three or more different subjects, most taught the subject Danish (often, the Danish teacher is the main

teacher responsible for the class) and more than half taught Physical Education in the class. For more information about the characteristics of the teachers, see appendix 4.

Program feasibility and barriers of implementation: Teachers believed that the AAYR program was a very feasible program to conduct, mainly due to the ease and flexibility of the program. They highlighted how it was perceived to be positive that the program could be implemented without the involvement of co-workers or the school principal. They identified were few barriers of implementation - the most prominent was time constraints. Despite many teachers not experiencing lack of preparation time to be a barrier, this barrier was prominent for some teachers. Further, another aspect of time was emphasised – the difficulty of implementing the AAYR program alongside the set academic curriculum. Some teachers overcame this issue, by incorporating the program with the academic theme the class was working with, which is in line with what the program itself suggests doing.

Reach: The majority of teachers explained how almost all students were able to and did participate in the program, since the program exercises were so easy to perform. Teachers perceived program reach to be high, and that the few students who were less actively engaged in the program activities, could not be described by any common characteristics. In particular, no differential participation of the students, who were more or less confident when it comes to physical activity, was identified.

Social cohesion in class: Several teachers experienced the AAYR program to positively affect social cohesion and established relationships in class, in that when using the program exercises, students interacted with each other in different ways than the teacher usually observed. However, though the large majority of teachers did not report this problem, one teacher did come forth with her experience that some students had been put on the spot, after using the student scorecard which revealed their individual health performances in class. As the program is meant to be adjusted to fit with the class situation, this teacher thereafter discharged using this part of the program. On the contrary, other teachers explained how they did not believe that the students were negatively exposed by participating in the program.

4.5 Paper III

To investigate if student- and school level context factors affect level of program implementation, I gathered and analyzed data from a teacher survey, a student survey and in-class observations of the 2017 AAYR program as well as data from a national register. This resulted in the article "*Do student social background and school context affect implementation of a school-based physical activity program*?".¹¹³ The materials and methods used will be presented below, and finally the results of this third article will be presented.

4.5.1 Materials and methods

In the following, a description of the school enrolment, study design and data sources used, data analysis, and ethical considerations will be presented. For a more detailed description about the scales used and collapsing of response categories, see **paper III**.

4.5.1.1 School enrolment

To enroll school classes in the study I first contacted the school principal of each school to gain his/her permission to contact the teacher who had signed up the school class for the AAYR program and ask if the teacher would be willing to participate in the study. To get in touch with the school principal I called every school between one and five times and sent out several e-mails. After permission was granted from the school principal, many teachers accepted after my first e-mail request, where some accepted after a follow-up phone call.

The sampling procedure of schools included the following steps. First, I received a list of all the fifth-grade school classes which had been signed up for the 2017 AAYR program by the 1st of June 2017. This timepoint was chosen to enable as many schools as possible to sign up, but still leaving time for recruitment before the program weeks in September. Besides the class grade (children 9-11 years old), schools were included if they: came from a Danish speaking public school, were signed up for the program by one teacher only, and had between 16 and 30 students in class. Participating schools were first selected based on geographic location (western versus eastern/middle part of Denmark, and small versus large cities) to ensure geographic diversity (see appendix 5 for the geographical placement of the included schools). This resulted in four clusters of eligible schools. Subsequently, schools were, within these clusters, randomly selected for participation. To further enable sociodemographic diversity, within each of the four clusters, schools from the randomly

drawn list were selected so that at half of the schools, the parental education level was above the national average, and at the other half of the schools, the parental education level was below the national average. School enrolment in the study was complete when 16 schools, who matched the inclusion and selection criteria, had accepted participation.



Figure 4: Participant flow of schools through the study Source: Guldager et al.¹¹³

712 schools were assessed for eligibility. 444 of these met the inclusion criteria and 32 schools were contacted for participation. Of these, 16 were excluded since they declined to

participate (13 schools) or gave no response (2 schools) where one school had accepted but was too closely located to an already included school (see figure 4).

4.5.1.2 Data collection

Data were collected from September to December 2017. The baseline student survey was conducted approximately one week before the AAYR program and consisted of data relating to student-level factors (gender, immigration background, family affluence and school connectedness), and the follow-up student survey was completed after the AAYR program to determine the implementation components of reach and dose received. The terminology and measurement of school connectedness used in health research varies widely.¹¹⁴ However, a common element often referred to is: "the extent to which students feel personally accepted, respected, included and supported by others in the school social environment".¹¹⁵ (p. 80) This definition of school connectedness was used in this study. Register data were utilized to determine school size and schools' parental SES level (further education). The teacher survey was conducted after the program to determine school context factors as well as the implementation components of dose delivered and fidelity (program conducted according to plan). In-class observations were performed during the three program weeks to determine the implementation component of fidelity in terms of the quality of program implementation by teachers. A timeline of the points of data collection can be found in figure 3 presented in chapter 4.1. Below, a further description of the four different methods of student- and teacher survey, observations, and register data, is presented.

Questionnaires for students and teachers

The teacher-survey consisted of questions, specifically developed for the study, regarding school-level context factors and the implementation components of dose delivered and fidelity. The specific variables derived from the teacher- and student-survey will be presented in the subsequent paragraph, and the baseline and follow-up student questionnaires are found in appendix 6 and 7.

Questions in the student survey regarding the implementation components of reach and dose received developed specifically for the study, where all questions regarding the student-level independent variables were obtained using questions from the Danish translation of the Health Behaviour in School-aged Children survey.¹¹⁶ All baseline student

data were collected by paper questionnaires, where the majority of the follow-up questionnaires were collected electronically. I was advised by the three teachers participating in the 2015 pilot study, to distribute the student questionnaires in paper format, and followed this advice for the baseline data gathering for the 2017 program. However, when I talked to the teachers during the in-class observations in 2017, I learned that most of them preferred electronic versions of the student questionnaire, thus this option was offered to those interested.

Observations of in-class AAYR activities

Observations of in-class program activities were done with the main purpose of observing fidelity, but observations also contributed to an adjustment of the interview guide used for the teacher interviews (**paper II**).

The AAYR program ran for three weeks/15 school days and the 16 included schools were located all over Denmark. To be able to conduct 16 observations over 15 school days, I had to bring in assistance, and observations were thus conducted by three people including me.

To facilitate consistent data gathering from the three observers, I developed an observation guide which was followed for each observation. This was informed by the pilot-observations I had conducted in three school classes using the 2015 program, and by the literature on fidelity⁵⁰. Thus, fidelity was assessed on rating scales in terms of implementation according to the program plan as well as quality of program implementation based on: the teachers' demonstration of knowledge of the AAYR program, the teachers' clarity in student instruction and their enthusiasm when using the program with the students.

One ordinary class session of between 45 and 90 minutes, where the teacher and students conducted one or more AAYR activities alongside their usual curriculum, was conducted per school. Observations were performed as non-participant observations since we observed class activities without engaging in these activities.¹¹⁷

National register data

In Denmark, a national register from the Ministry of Education¹¹⁸ collects data on different school level parameters, which are available to researchers on request. I obtained data on school size and schools' parental education level from this register.

4.5.1.3 Assessment of indicators

The assessment of the indicators for the independent and dependent variables, are described briefly below. For a more detailed description, see **paper III**.

Student level variables

The student level variables included in this study were: gender, immigration background, family affluence, and perception of school connectedness. These were, as described earlier, self-reported by the students. Immigration background was classified in two subgroups of being born "in Denmark" or "in another country/don't know". Family affluence was measured by six questions of the Family Affluence Scale (FASIII).¹¹⁶ Perception of school connectedness was assessed by a sum of three dimensions: school satisfaction (one question), peer support (three questions), and teacher support (three questions). Due to different scale ranges, results of these three dimensions were Z-transformed before being summed up.

School level variables

The school level variables included in this study were: school size, schools' parental SES level, physical activity policy, and school's prioritization of health promotion. School size and schools' parental SES level were, as described earlier, derived from a national register, where data on physical activity policy, and school's prioritization of health promotion were self-reported from the teachers. Schools' parental SES level was determined as the percentage of parents in the entire school, who had completed higher education.

Implementation level

The outcome variable of interest was a composite score of implementation level, derived as a sum of reach, dose delivered, dose received, and fidelity.

A special aspect regarding the implementation component of "reach" should be highlighted. As described in chapter 2, reach is most often defined as the percentage of the target group participating in the program.⁵⁰ For the AAYR program it was anticipated that reach in this term would be very high to begin with, as the program is implemented at school by the teacher - hence participation could be based solely on presence or absence of students in class.²⁹ To verify or reject this assumption, and in addition to studying reach as a *psychological component* in terms of student engagement for **paper III**, I gathered data on

reach in terms of the "traditional definition" of *percentage of students who participated* in the program (supplementary analysis). Teachers were asked "how many of the students do you believe in general, participated actively in the program during school hours?". 14 teachers reported reach in terms of participation to be 90% or 100% and two teachers reported it to be 80%. Thus, these results showed very high reach in terms of participation, thus confirming to study reach as a psychological dimension of student engagement.

Table 4: Data sources, collection periods and measurements used for the implementation components

Implementation component	Data source	Data collection period	Instrument/measurement
Reach	Student survey	Post intervention	Student engagement: 5-item survey
Dose delivered	Teacher survey	Post intervention	Degree of instruction of student scorecards & gameboard to students: 4 - item survey Frequency of instruction of frisbee exercises to students: 2 - item survey Frequency of instruction of music videos to students: 3 - item survey
Dose received	Student survey	Post intervention	Survey of the degree to which program elements were received: 11-item survey
Fidelity	Observation in class	During intervention	<i>Implementation according to plan</i> 3-item observation checklist (present yes/no)
	Teacher survey	Post intervention	6-item teacher survey (yes/no)
	Observation in class	During intervention	Degree of quality of program implementation 3-item observation checklist

As can be seen from table 4, the measurements used for the four different implementation components, varied in both type and number of measurements used. Based on the assumption that every component is believed to be of equal importance for implementation, as suggested by Linnan and Steckler,⁵⁰ each of the four components were assigned equal weight when being summed up and used as a composite score of implementation level.

Implementation level has previously been used as either a continuous variable or a categorical variable where groups of e.g. high versus low implementation are compared. Durlak and Dupree⁵³ in their review found that 42% of their 59 included studies analyzed implementation level as a continuous variable and 58% as a categorical variable. For **paper III**, implementation level was treated as a continuous variable. This was done since it would be very difficult to decide on a cutoff point for what would constitute as low versus high implementation and treating implementation level as a continuous variable would give more chance to detect an effect. Further, my main interest was not the development of an implementation index. This was a necessity in order to study my main research focus – i.e. the influence of *context factors* on implementation.

4.5.1.4 Data analysis

Data from the electronic teacher and student questionnaires were collected via the electronic system SurveyXact. All data (from the paper- and electronic student-questionnaires, teacher questionnaires, results of observations and register data) were imported to IBM-SPSS for Windows v. 23. As the paper student-questionnaires were manually typed into SPSS, 15% of the paper questionnaires were, as a routine error check, randomly selected and doublechecked before proceeding with the analysis. 0.02% typing mistakes were found.

To determine school connectedness, scores of school satisfaction (one item), peer support (three items) and teacher support (three items) were summed. For peer- and teacher support, missing values were replaced by the mean of the students' responses, only if answers to one of the three subscales were missing. Generally, there were very low rates of missing values for student- and school level factors, with less than 0.04% missing for these items. However, for dose received which was a sum of 11 items in the student survey, 18% missing data were detected.

I used descriptive statistics, including frequency distributions to check for outliners or other errors. Further, I applied independent t-tests to determine bi-variate associations between student social background and school context, and implementation level. Finally, to determine the individual contributions of the different independent variables on implementation level, multilevel linear regression was performed. Independent variables at a significance level below p = 0.10 were included in the multivariable analysis. I used a mixed model, due to the hierarchical structure of data, with students nested within school

classes. Histograms, scatterplots as well as normal P-P Plots were visually inspected to check for violations of assumptions for multiple linear regression, such as multivariate normality and homoscedasticity, and variance inflation factor was used for testing for multicollinearity. All assumptions were met. For further information of the statistical analyses, see **paper III**.

4.5.1.5 Ethical considerations

The Danish National Committee on Health Research Ethics decided that formal ethical approval of the study was not required, since the project is not a biomedical research project. School principals and teachers of participating school classes gave initial approval for students' participation in the study. The purpose of the study was explained to the students by their teacher, and parents gave written consent for their children's participation. All teachers, students and their parents were informed that participation was voluntary, and responses would be anonymized.

One of the most important factors to be aware of when children are involved in research, is the potential of children being embarrassed by revealing personal sensitive information to others.¹¹⁹ In my study, some of the questions dealt with the students' feelings about their peers and teachers, which may have been perceived as sensitive, if answers were disclosed to peers or the teacher. To ensure privacy for the students, we asked the teacher to place the students in class, in a similar way as if they were to conduct an exam, so they could not see each other's answers to the questionnaire. Further, students were informed that their answers would not be shared with their peers, teachers, parents, or the school principal. Teachers were instructed to ask the students to place their questionnaire in the provided cardboard box themselves, without the teachers' involvement.

4.5.2 Results

Because of a technical error, at one of the 16 schools, no observation was conducted, thus in-class observations were conducted at 15 of 16 schools (response rate 94%). All 16 teachers completed the teacher questionnaire. Of the 361 students in total attending the 16 school classes, 313 (87%) completed the baseline survey, and 276 of these (88%) provided data for the follow-up survey.

The bi-variate analysis revealed that, of the included student-level variables, only school connectedness was significantly related to higher implementation of the AAYR program. The school level variables of larger school size and higher school parental SES level were associated with higher implementation of the AAYR program. Further, school's higher prioritization of health promotion was borderline significantly associated with higher implementation. In the multi-variable analysis, higher school connectedness and higher parental SES level remained significantly associated with higher implementation level, while school size lost its significance in the adjusted model, when "school's prioritization of health promotion" was added to the model.

4.5.2.1 Descriptive results of implementation components (supplementary analyses)

As **paper III** utilized a composite score of implementation level, it is interesting to analyze, if the four components of this composite score (reach, dose delivered, dose received, and fidelity) accounted for equal or differential amounts of the composite score of implementation level. To enable comparison between reach, dose delivered, dose received, fidelity, and the total implementation score, results for each of these dimensions were quartiled and transformed into 1 to 4 points each.





The figure above illustrates the results of this analysis, which is not presented in the included papers. Key findings were that *reach* (in terms of the students' attitudes towards and engagement in the program) was very high, with more than half of the students being placed in the highest quartile. For *dose delivered* the majority of students were placed in the second quartile, with none in the highest quartile, while most answers fell into the middle quartiles for the *dose of the program received. Fidelity* was evaluated as high, with the majority of students being placed in the two highest quartiles and none in the lowest quartile. For the composite implementation score, the majority of students scores were placed in the middle quartiles, with none in the highest quartile. Thus, this supplementary analysis revealed that where the majority of students scores were placed in the middle quartiles. Further, the implementation components which received the highest points were reach, followed by fidelity and dose received, where dose delivered resulted in the lowest points. Interestingly, this analysis shows that students perceived to receive more program components (dose received) that teachers reported to deliver. However, additional bi-variate

analysis showed that, as expected, dose delivered and dose received (being in the lowest tertile) were significantly related ($\chi^2 = 11.35$, p < 0.01).

Chapter 5 Discussion

5. Discussion

In the following, a short summary of the main findings of this thesis will be presented, where after implementation feasibility, measurement of implementation, the influence of contextual factors on implementation, as well as the strengths and limitations of this thesis will be discussed.

5.1 Summary of main findings

The purpose of the studies included in this PhD thesis was to examine whether, and if so, which aspects of target group characteristics and social context modify implementation as well as teacher-perceived effectiveness of the "Active All Year Round" program. The quantitative findings from the first sub-study highlight that teachers' support from their school principal in implementation, schools' prioritization of health promotion and teacher's satisfaction with their schools' physical environment affected teachers' perceptions of effectiveness of the program (**paper I**). The qualitative findings from the second sub-study show that teachers described feasibility of implementation to be very high and identified very few barriers of implementation, the most important factor emerging being lack of time. Further, teachers described program reach in terms of students' active participation and engagement to be very high, and experienced that the program affected social cohesion in class in a positive manner (paper II). Quantitative findings from the last sub-study (paper **III**) indicate that of the investigated student- and school- level context factors, higher school connectedness and higher parental education level was found associated with higher implementation level. The overall findings of the three studies will be discussed in detail below.

5.2 Implementation feasibility

Findings of the qualitative sub-study presented in **paper II** emphasized the importance of the flexibility of the program for the implementation feasibility, which is in accordance with prior evidence.^{120, 121} It is interesting how this flexibility or program adaptation was viewed as positive and important by the teachers, since many researchers see program adaptation as implementation failure.⁵³ However, it has been argued that for school-based programs, adaption to some degree cannot be avoided and may even be desirable in order to meet the needs of different contexts,^{78, 122} which was confirmed by the findings of this PhD thesis.

In contrast to other research on implementation of school-based physical activity programs,^{123, 124} findings of the second sub-study revealed that teachers identified relatively few barriers of implementation (**paper II**). This might be due to the type of program implemented, which was comparatively small-scale, and may not indicate that implementing health promoting programs at school is generally unproblematic. It is possible that barriers were not that prominent in the given situation because of the simplicity and comparative brevity of the program. Thus, teachers could implement and enjoy the program, as it was realistic to implement it in a pressured school world. Further, however, this finding could to some extent also reflect the bottom-up approach of the AAYR program where teachers themselves sign up their school classes for program participation. Thus, teachers who participated may have had a more positive attitude towards physical activity promotion in school, which could have led them to perceive less barriers of program implementation.

Of the few barriers of implementation identified, the most prominent was lack of preparation time (**paper II**). Lack of time being a barrier for implementation is well established in the literature on school-based health promotion,¹²⁴⁻¹²⁶ however that only some teachers in our study experienced this barrier may again reflect the flexibility and simplicity of the program, or might be due to the fact that the actual context, including availability of resources or competing demands, may have been different for these teachers. In accordance with previous research,^{120, 124} this sub-study (**paper II**) identified a further dimension on the issue of time constraints, in that teachers in particular experienced difficulties in working with the program when they already had a tight academic schedule to follow with the school class. In the AAYR program material, it is suggested to combine the AAYR program with the academic content⁹. In line with previous research,¹²⁷ I found that teachers, to facilitate program implementation when having a tight academic time schedule, did in fact combine the AAYR program with existing academic content.

As described above, findings of the qualitative sub-study indicated that teachers perceived the program to be easy to conduct, highly feasible to implement, and perceived very few barriers of implementation (**paper II**). However, the results of **study III** seem to somewhat challenge this viewpoint. High perceived feasibility might – at first glance - suggest that *fidelity in terms of adherence to the program plan* and *dose delivered* would also be quite high. Interestingly, these two implementation components were actually lower than expected

and no schools were in the highest quartile for dose delivered (data were presented in the supplementary analysis based on data for **paper III**). This could be explained by the program's embedded possibility to adapt the contents to the local setting. While teachers were provided with a detailed plan of which core program elements to implement and how to implement them it was up to the teachers to decide the dosage of the program exercises, they wanted to implement.

5.3 Measuring implementation

The measurement of implementation is often experienced as being complex and challenging,^{75, 78, 80} which was also the case for this thesis. The complexities experienced for this PhD thesis regarding the implementation components of reach and the composite score of implementation level, will be discussed below.

5.3.1 Reach

In this thesis, program reach was studied in different ways and from different perspectives: qualitatively from the teachers' perspective (**paper II**), and quantitively from the teachers' (supplementary analysis) and students' perspective (**paper III**). These different perspectives and data sources highlighted different interesting aspects of reach, which will be discussed below.

In the qualitative study (**paper II**) reach was studied from a teacher perspective in terms of students' active participation and engagement. Findings indicate that teachers perceived reach to be high. They explained that almost all students could and did participate in program exercises, that is, teachers could not name any specific group of students who did not participate. In general, health promotion programs have been criticized for reaching those less in need for behavior change to a higher degree than those more in need¹²⁸ but according to the interviewed teachers, the AAYR program does not appear to favor those less in need of improving their levels of physical activity. However, this reflects only a limited perspective based exclusively on teachers' views (see further elaboration on this in chapter 5.4.1 regarding school connectedness).

Linnan and Steckler have defined reach as the proportion of the target group who participates in a program and emphasized that reach is a characteristic of the target group.⁵⁰ It can be debated if the target group in this situation would be the students or the schools?

Reach has previously been studied as a characteristic of the student population of the included schools against the general population,⁴⁰ however this perspective was out of scope for this thesis (see chapter 2.5). For the second and third sub-study, reach was instead studied at the student level (**papers II** and **III**). Reach as student participation rate was expected to be generally high in a school setting,^{29, 129-131} with limited variation,²⁹ thus merely reflecting absence/presence of the students but not revealing much about actual engagement. Supplementary analyses in this thesis (see chapter 4.5.1.3) were consistent with these assumptions as rates of reach in terms of student participation proved to be very high.

For the reasons described above, in the third sub-study reach was treated as a characteristic of the target group in terms of students' attitudes towards and engagement in the program, and not as mere participation rates of the target group (**paper III**). However, when more detailed supplementary analyses were conducted for the thesis, it was found that on average reach as a psychological component, was also quite high, though there was considerable variation in the variable (see figure 5 in chapter 4.5.2.1). It should be recognized however that the reasons behind the students answers to the questions targeting reach (in terms of attitudes towards and engagement in the program) are unknown. They could be reactions to the type of the program exercises, but also to the fact that the exercises were conducted doing class time, and/or the competition element might have been a particularly motivating factor for some students. This could be interesting to pursue in future research.

The different perspectives and analyses of reach in this thesis add to the implementation research field. Where previous studies on school-based physical activity programs have similarly identified reach, in terms of student participation, to be high,^{129, 130} to my knowledge no other studies in this area have treated reach as a psychological component.

5.3.2 Composite score of implementation level

The importance of documenting the reliability and validity of the implementation measures used has been highlighted by Durlak & Dupree,⁵³ however to my knowledge in this field there is no consensus on the most reliable and valid way to measure level of implementation.^{10, 132} Further, it is acknowledged^{50, 53} that in implementation studies a common standard is difficult to achieve since all programs differ and therefore it is unlikely that all aspects of implementation can be measured by standard instruments. Thus,

developing individual study-specific measures, as it has been done for the third sub-study of this PhD, can be necessary.

While reviews of implementation studies have pointed out that many studies rely on only one, or sometimes two implementation components, 53, 68, 78, 84 more or less implicitly treating these as "replacements" for overall implementation quality, the present study uses four implementation components which are summed up to a composite score indicating the overall level to which implementation has been achieved. This procedure is based on the evaluation framework by Linnan and Steckler who suggested determining program implementation as a summary score based on precisely reach, dose delivered, dose received and fidelity.⁵⁰ By simultaneously taking into account different components or subdimensions such a measure has the advantage of allowing for a more thorough, comprehensive, and balanced assessment of implementation. Seen from this perspective, the subdimensions reflect different demands for implementation which to a certain extent all need to be met for a successful operation of a project. A certain level of "dose delivered" by the program operators, for instance, is a necessary precondition for changes in the target group, which, however, without an adequate level of actual "dose received" (e.g. due to potential recipients actually being physically present at delivery) will not be able to enable this change.

A summary measure of implementation can therefore be conceptualized as a formative index reflecting a joint total of partly related but also partly separate individual components (causal indicators).

For the third sub-study of this PhD, empirical investigation of the associations indeed indicated moderate to medium-sized associations between the different subdimensions, with the highest correlation found for dose-delivered and fidelity (r = .58; p < 0.001) and the lowest for reach and fidelity (r = .23; p < 0.001) (see table 5 in appendix 8). That all subdimensions are correlated to some degree shows that there is a certain overlap between the subdimensions, and that they do share some variance. However, the correlations do not exceed r = .58, thus they do in fact tap into specific, different aspects of implementation.

The extent of the associations may be dependent not only on the different "contents" targeted but also reflect the different sources performing the ratings. The strongest

correlations, not surprisingly, were found between the subdimensions which came from more or less the same data source, that is student/student (reach and dose received), and teacher/teacher & observations (dose delivered and fidelity), so there is shared measure variance (see table 5 in appendix 8). Further, dose delivered and dose received are among the subdimensions which have the lowest correlation (r = .31; p < 0.001) (see appendix 8). This could be explained by the fact that these subdimensions measure both shared but also different aspects of program implementation. Shared aspects were for instance instructing/conducting frisbee exercises and dancing to the music video, where differential aspects were e.g. the teacher registering the class score on the webpage (dose delivered) and physical activity behavior of students at home and to and from school (dose received). Furthermore, these subdimensions utilized partly different response categories tailored towards the different types of respondents (children vs. adults). Thus, for instance students were asked to rate the degree of program usage while teachers indicated the number of times program components were used as well as the degree of usage. For these reasons, dose delivered and dose received cannot be expected to be highly correlated.

Prior studies of implementation of school-based health promotion programs have likewise used a composite score based on several components.^{72, 133-136} However, studies adhering to the specific implementation components suggested by Linnan and Steckler,⁵⁰ primarily used only one or more of these components separately.¹³⁷⁻¹⁴⁹ To my knowledge, no other studies have based the composite implementation score on the four components of reach, dose delivered, dose received, and fidelity. However, a Danish study¹³¹ on the effectiveness of a school-based hand hygiene program created an implementation index using a combination of reach (defined as the proportion of children in each class who received the intervention component) and dose received (defined as the extent to which the child indicated that they participated in or experienced the program).

Using a composite score of implementation does, however not solve the problem of comparing results across studies, as inconsistencies still exist in the way implementation is defined and measured^{53, 69, 75, 81, 82} regardless of whether separate implementation components or a composite score are used.

It could be discussed though if a simpler implementation score could have been constructed by using only one data source. In previous implementation research, teachers' self-report

on program adherence (which relates to the construct of fidelity), has been found to be negatively correlated with assessments of adherence made by independent observers.⁸³ This could provide an argument for utilizing observations only to study level of implementation, assuming that independent observers are more "objective" than teachers who are likely to have a vested interest in the success of their inputs.¹⁵⁰ Using such an approach was not deemed possible though, due to the given circumstances. Firstly, I assessed fidelity both by observation as well as by a teacher survey, since some of the aspects of program implementation could not be assessed by observation only (e.g. the teacher registering the class score on the webpage, distributing parent information sheet etc.). Further, assessing reach, dose delivered, and dose received of the program throughout the three program weeks by observations was not deemed feasible due to 1) the immense resources this would have required, and 2) the fact that such an approach would very likely have affected the students' usage of the program and the teachers' implementation of the program to an unacceptable degree. Vice versa, using solely data from student questionnaires or teacher questionnaires was not possible, since the included implementation components inherently require the perspective of the different groups, regarding e.g. dose delivered (from teachers) and dose received (from students). Thus, constructing an implementation score from a single data source was not deemed possible or at least seemed reductionist.

5.4 Context factors influencing implementation

This thesis has been guided by the Medical Research Council's Framework⁴⁸ as well as the evaluation framework of Linnan and Steckler⁵⁰ where context is highlighted as a key component of a process evaluation. The purpose of this thesis was to investigate whether, and if so, which target group characteristics and school context factors affect the implementation and teacher-perceived effectiveness of the AAYR program. The target group characteristics and school context factors and third sub-study (**papers I** and **III**) will be discussed below.

5.4.1 Target group characteristics

Findings from **paper I** on perceived program effectiveness indicated that teachers of *younger students* more often perceived positive change in students' attitudes towards physical activity compared to teachers of older students. This may be explained by the type

of program implemented, as the program is focusing on fun and "crazy" activities which might have been more appealing to younger students. This finding of an age difference is in correspondence with a narrative review ¹⁵¹ summarizing the evidence of the effectiveness of physical activity programs in children and adolescents, which reported that for children, school-based programs were the most effective intervention type for physical activity interventions while different settings were effective for adolescents.¹⁵¹ As data for **paper II** and **paper III** were gathered for students in fifth-grade (9-11 years old) only, the factor "age" could not be investigated since the age difference between these students was limited to one or two years.

Findings for the relevance of parents' socioeconomic status are to some extent discrepant. On one hand socioeconomic status in terms of family affluence was not significantly associated with implementation at an *individual* student level (paper III), which is in line with findings from the qualitative study (paper II) where teachers did not perceive differential participation in the program by different groups of students in class. On the other hand, the related concept of higher parental education level at the school level was, in correspondence with prior evidence,¹⁵² associated with higher implementation (**paper III**). This contradiction of results between and within the sub-studies may foremost reflect differences in measurements used. It may be problematic to use the Family Affluence Scale (FAS III) in a country like Denmark where the distribution of the variable tends to be severely skewed, since FAS III is predominantly based on indicators of material goods and resources that are widespread in Denmark. Further, it could be conceived that the differences of findings regarding the relevance of parents' socioeconomic status for implementation are rooted in the different levels of assessment. Thus, at an individual student-level, children's background might make less of a difference than at the school level - that is the collective background of a student clientele within a school or a class. The latter was assessed for the third sub-study (paper III) and for the first sub-study (paper I), which examined teacherperceived level of parental education in class and yielded weaker change perceptions in physical activity attitudes for students from lower as compared to medium high educational background. Schools located in socially more disadvantaged areas might have more problems finding the resources or the opportunities to fully implement even smaller-scale programs outside the given academic program. Seen from this perspective, parental educational level might arguably be more of a school-level than an individual student

characteristic. Another explanation could be that schools with a higher proportion of children from high SES backgrounds are often also characterized by a higher involvement of parents who are more willing to support their children's engagement in physical activity,^{153, 154} thus facilitating program implementation.

That the program was implemented to a higher degree when students had higher school connectedness (paper III) is a novel contribution to the field, as, to my knowledge, no other studies have explored this relationship between school connectedness and implementation. School connectedness has been found to be associated with a variety of positive outcomes such as better emotional health,¹⁵⁵ higher grades,¹⁵⁶ not skipping school,¹⁵⁶ and better academic achievement.^{157, 158} Teachers of classes with higher school connectedness may thus experience less challenges with the school class in general, leaving more time and energy to implement a health promoting program. However, this finding could be viewed as somewhat contradictory to the main results of the qualitative sub-study (paper II) where teachers did not perceive differential program participation by different groups of students. One reason for this discrepancy could be that teachers in the face-to-face interview situation (paper II), due to social desirability, may have underestimated or downplayed potential difficulties in using the program material for different groups of students. More importantly however, this discrepancy could be explained by the difference in measurement in the two sub-studies (papers II and III). Thus, this may be an "unfair" comparison, as in the interviews teachers were asked about a single dimension of implementation (reach) (which in the subanalysis also had turned out being "high") while the summary index for implementation applied in the third sub-study (paper III) also considers other dimensions (dose delivered, dose received, and fidelity) which the teachers in their judgement did not factor in (paper II).

5.4.2 School context factors

Teachers being satisfied with the *support they received from their principal* in implementing the program were more likely to perceive effectiveness of the AAYR program (**paper I**). The relevance of managerial support for implementation of school-based programs promoting physical activity^{126, 159} and in other health areas^{122, 160-162} is frequently reported, and may be explained by school principals' influence on allocation of tasks and structural resources and/or on school climate in general. However, a study of a French school-based health promotion program¹⁶³ explored interactions between contextual factors and found that in
cases where parent/school relationship was very weak, this parent/school relationship seemed to override the beneficial effects of supportive leadership. An interesting focus for further research could definitely be possible interactions between different contextual factors.

On a different note, the second qualitative sub-study (**paper II**) did not confirm a major importance of support from the school principal. However, that might be due to the fact that these teachers, compared to teachers for sub-study one, had invested more time and resources being a part of the research project. Thus, these teachers may have placed more focus on their own role in implementing the program. Thereby they could have reflected upon supervisor support in terms of the principal providing hands-on arrangements for this type of program, such as helping with explaining the parents about the program, setting up facilities for the specific program exercises etc., and not on supervisor support in terms of the principal activity in general such as providing the time needed and/or encouragement of the teachers in implementing a physical activity program for the students.

There was also some evidence that the school's general commitment to creating a health promoting environment mattered for implementation. School's higher *prioritization of health promotion* was significantly associated with both indicators of perceived program effectiveness in the first sub-study (**paper I**) and showed a non-significant trend of being positively associated with higher implementation in the third sub-study (**paper III**). This may indicate that at schools where health promotion is prioritized, schools may provide more material resources and allocate more time to health promoting programs, which can enable higher perceived program effectiveness and possibly program implementation.

As for the physical school environment, which might be especially relevant for a physical activity programs, findings from **paper I** indicated that teachers who were not satisfied with the *schools' physical environment* for implementing physical activity were less likely to report positive change in students' level of physical activity after participation in the AAYR program. Thus, implementation of physical activity programs may be more difficult in settings not adequately equipped in terms of recess grounds, classroom space or sports facilities. This finding is in line with previous research of school outdoor physical environment and physical activity levels in children.^{164, 165} It would definitely have been interesting and relevant to also

study if schools' physical surroundings in terms of absence/presence and quality of equipment for physical activity at school as well as a surrounding area being supportive of physical activity (such as for example bike lanes, safe pedestrian crossings, and speed bumps) would affect the implementation level of the program. Data on this aspect has been collected and will be analyzed in the nearby future.

The findings of this thesis confirmed that using a socio-ecological perspective^{51, 52} was a productive approach to studying contextual factors of implementation, as aspects of both student- *and* school-level factors were in fact found to influence implementation and perceived effectiveness of the AAYR program.

5.5 Methodological considerations

5.5.1 Strengths and limitations

As for teacher-perceived effectiveness (TPE) investigated in the first sub-study it should be recognized that TPE reflects short-term subjective evaluations of effectiveness only (paper I). Yet teachers' view is crucial, since they are the ones who in most cases implement schoolbased health programs and only positive evaluations of such efforts will ensure continuous motivation.⁵⁶ Also, it was not absolute estimates of program effects which were the main focus of this sub-study but relative differences between teachers conducting the same program in different social contexts. Nevertheless, whether actual and longer-term attitude or even behavior change is achievable with a classroom competition program needs further investigations based on controlled study designs. Further, it could be argued that TPE measured immediately after program completion may be a problematic measure of perceived effects as it may at least partly reflect implementation rather than effectiveness. For example, teachers who experienced problems during implementation may have conducted only a limited number of physical activity program exercises with the students. When asked about behavior change right after program completion these teachers may have reflected upon this lack of implementation in the preceding program weeks and based their answers at least partly on this time period instead of exclusively on whether they actually perceived a change in the students' attitudes and level of physical activity after the program had been completed. Hence, teacher-perceived changes in behavior due to the program may to some degree also reflect the implementation of the program rather than perception of effects only.

Each of the three sub-studies of this thesis (one with a qualitative and two with a quantitative approach) were conducted independently to answer each of three individual research questions, and results of the sub-studies have been discussed against each other in this thesis. Steckler¹⁶⁶ has suggested different models of how qualitative and quantitative methods can be integrated. For this PhD work, I used a model where the quantitative method was the predominant choice and the qualitative method was used mainly to explain the quantitative findings.¹⁶⁶ Thus, the qualitative results (**paper II**) have been used to interpret the results of the quantitative findings but in doing so to also contribute to the overall aim of the thesis.¹⁶⁶

Integrating qualitative and quantitative methods has been criticized with the argument that the two paradigms are so different that they cannot be combined, since the purpose of the two are either prediction or intelligibility and cannot be both.¹⁶⁶ However, in general this exclusion is not accepted, that is, that most researcher maintain that the two paradigms can certainly be combined, and the research method should be selected as to best suit the purpose of the research.^{48, 103} This further aligns with Creswell's¹⁰¹ "philosophy of pragmatism" which suggests that the choice of research methods should be based on what the most effective way to answer the research question is. Further, in process evaluations in particular, using both qualitative and quantitative methods for data collection is common, as it allows for more rich and detailed information about program implementation.⁵⁰ For this thesis, it has proved to be beneficial to utilize both methods, as each has provided a different kind of knowledge. It is clear that the quantitative research method is best suited to answer the first and third objectives of the thesis - that is to examine the possible link between school social context factors and teacher-perceived effectiveness of the program (first objective) and to examine if student level and school level context factors affect the level of program implementation (third objective). This quantitative perspective allowed for a broader data base, with its advantages regarding generalizability¹⁶⁷ of the findings. Further, by also utilizing the qualitative method, this thesis added in depth knowledge on teacher-perceived feasibility of program implementation, as well as implementation barriers, program reach and the programs' influence on social cohesion (second objective). Using a qualitative method gave a richer and deeper description of the phenomenon than the quantitative method alone would have allowed, and the knowledge produced has been essential to provide a better understanding and interpretation of the results of the third sub-study (see

chapter 5.2, 5.4.1, and 5.4.2). This thesis could have benefitted from an additional qualitative sub-study to support and interpret the results of the first sub-study (paper I). Such a study could have added an understanding of how exactly the physical environment hindered or enabled teacher-perceived effectiveness of the AAYR program, and in what way exactly the schools' prioritization of health promotion supported or hindered program implementation. This could be interesting to pursue in further research. In sum, for this thesis applying a multi-method design¹⁰⁰ proved to be useful as this contributed to a wider and more thorough understanding of the implementation of the AAYR program, which would not have been accomplished by one method alone. Information on how the program was used in the reallife setting came from in-class observations. In depth knowledge of the teachers' experiences with implementing the program came from qualitative teachers interviews, and quantitative data for investigating the association between context factors and implementation level came from register data and teacher- and student surveys. Data for papers II and III were collected simultaneously and to avoid cross-fertilization of ideas and data¹⁰⁰ qualitative data were analyzed first followed by analysis of the quantitative data. Thereby the risk of affecting the interpretation of the qualitative data was minimized. In fact, as the preceding discussion in chapter 5.2, 5.3, and 5.4 highlights, some contradictions between the findings of the quantitative and qualitative sub-studies did appear. This highlights the importance of utilizing both methods, since if only one method had been used, these contradictions would not have been revealed.

5.5.2 Validity, reliability and generalizability of results

Some types of bias may have affected the validity, reliability and generalizability of the results presented in this thesis. The main biases of relevance for this thesis will be discussed below.

Several issues, such as selection bias and self-reporting bias (social desirability bias and recall bias), may have affected the validity of the results presented in this thesis. For **paper I**, the response rate to the survey was comparatively low, which is common for this type of survey.^{37, 39, 168, 169} For **papers II** and **III**, despite schools being randomly selected for participation in the research project and the response rate being high compared to other Danish studies on school-based health promotion,^{37, 39, 168, 169} still only half of the schools approached accepted participation. These response rates for the two studies presented in

papers I, II and III may suggest a potential selection bias which can have affected the internal and external validity of the study.¹⁷⁰ It cannot be discounted that participants in the research project were the ones who felt most positive about the AAYR program and were more interested and engaged in the program, thus implementation and perceived effectiveness may have been overestimated. However, regarding paper I it should be noted that the 2015 AAYR program was running for the 11th time, and teachers had been provided with the opportunity to fill out a questionnaire after program participation for the last nine AAYR programs. As the majority of participants in the 2015 program had taken part in the program in earlier years, they may have felt it unnecessary to provide feedback every time. Therefore, non-participation may have been less biased towards the variables of interest in the study but may have been mostly due to prior program participation. Concerning papers II and III, non-responder analysis revealed that there were no marked differences regarding geographic distribution of the schools, school size, or school parental educational level between included schools and those who declined participation/gave no response. Further, included schools actually had higher percentages of students with an immigration background than schools who declined participation/gave no response. In general, it does therefore not appear as if participating schools for papers II and III represented a student clientele biased towards the higher socio-economic end of the scale, which otherwise is common in studies where participants are self-selected.¹⁷¹

Two types of possible self-reporting bias¹⁷⁰ should be considered for this thesis. Firstly, since anonymity at the time of data collection was not possible for study II (**papers II** and **III**), social desirability bias¹⁷⁰ may have led teachers to underestimate implementation difficulties (**paper II**) and overestimate implementation level (**paper III**) affecting the internal validity of the study.¹⁷⁰ However, we attempted to reduce the bias of potential overestimation of implementation level^{172, 173} by establishing implementation level from different data sources, that is observations by "neutral" external observers as well as self-reporting by teachers but also students, and by informing teachers (before project initiation) of the importance of conducting the program in the same way and to the same degree as they would have, had they not been a part of the research project. Further, self-reporting bias may have been limited since teachers were assured absolute confidentiality and were informed that they could speak completely freely, since the project was actually about identifying possible problems with the program, not with their teaching. Another type of self-reporting bias¹⁷⁰ to

be aware of in interpreting results presented in **paper III** is the possibility of recall bias¹⁷⁰ regarding the students' self-report data. Students were asked to report on the implementation components of reach and dose received only after the AAYR program had finished. It is possible that some children may have had difficulties remembering which parts of the program they actually received, hence affecting the internal validity of the study in that students possibly may have over- or underestimated the dose of the program received. However, we tried to reduce this type of bias by completing the survey immediately after program completion. Further, the program was completed over a relatively short time-span which have made it easier for students to remember details about their participation. However, it would have been desirable to record the dose received by document analysis. One way of doing this could have been by analyzing the results of the students' program scorecards, where students were to note down their daily health activities. However, this proved not to be possible as we were not able to get complete access to these documents. Further, to eliminate or reduce recall bias, the dosage of the number of frisbee exercises and dancing to the music video the students received, could have been documented through a daily electronic student survey. However, we judged that this was not feasible as this would possibly affect the students' usage of the program and the teachers' implementation of the program, to a degree which was unacceptable. Thus, utilizing a student survey immediately after program completion proved to be the best method to measure the dosage of the program delivered to the students.

Further, the assessment instruments used could be discussed in terms of reliability and validity. Concerning the first sub study (**paper I**) it could be argued that to strengthen reliability as well as validity of assessment, more complex multi-item measures of some of the characteristics which were investigated could have been chosen over the single items that have actually been employed. This applies mainly to the construct of supervisor support, as this certainly is a multidimensional construct. However, we measured *satisfaction* with supervisor support and not supervisor support per se (which is multidimensional) and beyond that, one-item measures have previously been shown to be effective in determining that supervisor support is an important factor for successful implementation of school based health promotion in general,^{122, 162} and in school based physical activity programs.¹⁵⁹ Also, including a more complex multi-item measure did not seem feasible due to the considerable length of the questionnaire, which also included series of items regarding different evaluative

aspects of the AAYR program (not covered here), used solely by the developers of the AAYR program. Using single-item measures was not problematic regarding the socio-demographic background measures (number or immigrants in the class, parental employment status, and parental educational background) which were factual factors measured in percentages. In the same way, prior program participation of the teachers and existence of a school physical activity policy were factual factors measures with a yes/no response. Teachers were asked to rate their satisfaction with the schools' prioritization of health promotion in general, on a 7-point scale from not satisfied to very satisfied. As was evident for the measure on supervisor support, again we measured satisfaction with the school's prioritization of health promotion and not the level of prioritization of health promotion per se. The measure of satisfaction with school physical environment for physical activity was a multi-item sum score on six different aspects of the physical conditions at school (playground, schoolyard, gym, hallways, classroom, equipment). Cronbach's alpha for the six sub scales indicated good reliability ($\alpha = 0.80$). In my study an already established measure of the physical conditions at school could not be used, since the measure had to fit with the specific physical activity requirements for the AAYR program, which is also intended to be used in the classrooms and at the hallways of the school. However, the measure developed for the study is, to some extent, similar with those used in the HBSC study¹⁶⁵ and other studies^{174, 175} to determine school physical environment for physical activity.

As introduced in the beginning of this chapter, a potential selection bias may have affected the external validity of the first sub-study (**paper I**). Thus, the outcome variables of perceived changes in students' attitudes and physical activity behavior may have been overestimated. It would have been desirable to use multi-item measures to determine these outcome variables, as this could have provided with more information regarding which different sub-areas of behavior change was perceived, where the behavior change was seen, and at which types of program activities the behavior change was seen. This would have made the results more precise, however, as presented earlier, including more complex multi-item measures did not seem feasible due to the considerable length of the questionnaire. Thus, the single item measures utilized to determine the outcome variables in this study must be conceived as a rough indicator, which is certainly prone to bias.

In the third sub study (paper III) of this thesis all student-level independent variables came from the internationally standardized and validated Health Behavior in School-aged Children's Survey (HBSC).¹¹⁶ Thus these questions have already been extensively tested¹¹⁶ which ultimately can result in obtaining data of higher quality.¹⁷⁶ As the HBSC-study does not have a standardized way of determining school connectedness, I was, through personal communication with the developers of the Danish HBSC study, recommended to utilize the three measures of: school engagement, student support, and teacher support, as a sum score to determine school connectedness. For my study, Cronbach's alpha for the three sub scales (school engagement (one item), student support (three items), and teacher support (three items)) indicated good reliability ($\alpha = 0.80$). Regarding school-level data, data on school size and schools' parental SES level were assessed by self-reported measures but came from registry data, while data on schools' prioritization of health promotion and existence of a school policy for physical activity was developed for the first sub-study, see discussion above. To strengthen the reliability of data used in the third sub study (paper III), I gathered data from multiple data sources (observations, student- and teacherquestionnaires and a national register). This is recommended in process evaluations of health promotion programs, as different data sources may generate different conclusions.¹⁰²

Further, it should be noted that the composite implementation score developed for **paper III** needs further validation and more research based on a larger sample. It would have been desirable to first conduct an extensive pilot study to test this measure of implementation level for its stability, i.e. test-retest reliability. However, this was not deemed feasible or possible within the timeframe of this study since it would have required for the instrument to have been applied for e.g. the 2017 AAYR program, and then repeated for the 2018 AAYR program. Furthermore, this would require the AAYR program to be identical two years in a row – which is not the case since the program is (in parts) altered every year, which does not allow for a test-retest of the implementation instrument.

The second sub study (**paper II**) was a qualitative study where the concepts of validity and reliability are conceived differently than in quantitative research.¹⁷⁷ In fact, within a qualitative research paradigm these two concepts are often viewed as inadequate,¹⁷⁷ and some researchers even see the concept of reliability as irrelevant in qualitative research.¹⁷⁷ Lincoln and Guba¹⁷⁸ have stated that reliability is determined by the validity of the qualitative study,

thus demonstrating validity is sufficient to establish reliability. Yet, even defining what constitutes validity in qualitative studies has diverse perspectives.¹⁷⁹. However, there is some consensus that in conducting qualitative studies researchers need to demonstrate that their research is credible.¹⁷⁹ Terminology aside, in this thesis, the validity of the qualitative sub-study has been discussed earlier in this chapter. Further, as suggested by Green and Thorogood,¹¹⁰ during data analysis I attempted to maximize reliability by conducting my analysis and notes in a thorough manner and by discussing my coding with colleagues, in this case my supervisor team.

Finally, in any research it is important to address to which extent the findings can be generalized to populations beyond the one participating in the study.^{117, 167} As presented earlier, regarding possible selection bias concerning the first sub study (paper I), nonparticipation in this study is to a large extent expected to be due to prior program participation and not the variables of interest, thus not affecting the generalizability of the findings. Regarding sub studies two and three (papers II and III), it can be argued that the included schools in the studies may not be a nationally representative sample of schools which may have limited the generalizability of these findings to Danish schools in general. However, we have tried to minimize bias as schools have not been self-selected. Further, the nonresponder analysis did not reveal any marked differences on school size, education level of the parents (school level), and geographic distribution (eastern/middle vs. western part of Denmark) between the included schools and those who declined to participate/gave no response. Actually, included schools had a higher proportion of students with an immigration background than those schools who declined to participate/gave no response. Thus, in general it does not appear that included schools represented students biased towards the higher socioeconomic end of the scale. However, it cannot be excluded, as pointed out earlier, that schools with more favorable attitudes towards physical activity may have been the ones who accepted participation. This could have led to some overestimation of the degree of implementation.

Findings of this thesis (**papers I, II** and **III**) may only be generalized to other countries with caution. Results may be most applicable to other countries which are more similar to Denmark regarding social and economic conditions, as well as the structure of the school system. Further, it should be noted that since 2014 it has been compulsory by law for Danish

schools to incorporate at least 45 minutes of physical activity per school day,²⁴ so Danish teachers are somewhat used to conducting classroom-based physical activity. Thus, compared to countries where teachers are not so experienced in conducting classroom-based physical activity, Danish teachers may have identified fewer barriers of implementation of the AAYR program (**paper II**) that teachers less experienced with conducting classroom-based physical activity would have.

Chapter 6 Conclusions

6. Conclusions

The overall aim of this thesis was to investigate whether, and if so which aspects of school social context and target group characteristics modify implementation as well as teacherperceived effectiveness, of the "Active All Year Round" program. This aim was specifically addressed by three separate sub-studies.

Results suggest that teachers were very positive towards the program, found the program to be feasible to conduct due to the flexibility of the program, and experienced very few barriers, the most prominent being time constrains. Further, reach was perceived as being high and no differential participation of students was reported by teachers.

Specific aspects of target group characteristics were identified as being associated with implementation or teacher-perceived effectiveness of the program. Thus, implementation level was higher in classes where students had higher school connectedness and in schools with higher parental SES level. Furthermore, teachers of younger students more often perceived positive change in students' attitudes towards physical activity compared to teachers of older students.

Further, certain aspects of school context did affect teacher-perceived effectiveness of the program. Results indicated that schools' prioritization of health promotion, teachers' support from their principal in program implementation, as well as teachers' satisfaction with the schools' physical environment for physical activity made a significant difference in teacher-perceived effectiveness of the program.

The findings of this thesis add to the so far limited knowledge of which contextual factors affect implementation and teacher-perceived effectiveness of school-based physical activity programs. Based on the findings of this thesis it can be concluded that context does matter in implementation of the AAYR program.

6.1 Perspectives and directions for practice

The results of this thesis highlight that before implementing health promoting programs there is a need for stakeholders and school heads to consider several structural aspects in general. First, since lack of time is consistently found to be a barrier of implementation of schoolbased physical activity programs, school heads could and should consider to at least temporary lower teachers' workload in other areas before implementing health promoting programs at school in order to enable higher implementation. It is recognized however, that this may not always be feasible due to resources restrictions.

The results of is PhD thesis show that the physical environment is important for teacherperceived effectiveness of the program. Stakeholders and school heads can build upon this result by, before program implementation, enhancing the physical environment such as school hallways, schoolyard, and physical activity equipment. This with the purpose of enabling better implementation and thereby provide the basis for increased program effectiveness, but also by enabling physical activity in general at school independent of the specific program with the purpose of promoting health benefits and preventing lifestyle diseases among the students.

Further, stakeholders should consider the possible association between school connectedness and implementation of their program. Schools with deficits in that area may benefit from providing systems to support implementation of health promotion programs, such as for example initiatives to foster a greater feeling of connection to the school by the student. Program components of such initiatives could be targeted towards subdimensions of school connectedness such as social relations within the class and between teachers and students. In this thesis it was also identified that teachers experienced that the program positively affected social cohesion in class, thus the program itself could provide a better school connectedness. There appears to be a spiral of reciprocal influences since the program can influence school connectedness and school connectedness can influence the implementation of the program in return. Thus, schools may benefit both from implementing the AAYR program itself and from providing other specific initiatives targeted toward social relations within the class and between teachers and school connectedness.

Implementation was found to be higher in schools with higher parental SES level. It is alarming that even in countries like Denmark, which compared to other societies are relatively "equal", due to the universal welfare-state system, such differences can occur. It

should be recognized though that the effect sizes found for the association between schoollevel SES and implementation were not so large that it would suggest a strong discrepancy. This suggests that schools with many students from socially less advantaged social backgrounds may, for instance, benefit from establishing systems to support teachers in their work, such as programs providing families with direct support, regarding ways of how to change and sustain health behavior, for instance by use of external coaches funded by the communities.

Finally, future developers of health promotion programs should consider the importance of explicitly incorporating the option for adaptation of the program to the local situation. Thus, health promotion programs should be realistic to implement in a school setting where teachers are pressured by the tightness of the academic curriculum, restricted teacher preparation time in general and competing initiatives.

6.2 Perspectives and directions for future research

Future research could build and expand upon the findings in this PhD thesis by including the perspectives of the parents and school principals. For instance, other types of contextual factors could be explored, such as school organizational factors and parental attitudes towards and experiences with being physically active, for their possible influence on implementation and perceived effectiveness of school-based health promotion programs.

Further, including the students' and parents' perspective in a qualitative study could reveal their roles and experiences with the competition approach of the program as well as any possible influences of the background of the students, or their influences from home and their everyday life on their participation in health programs.

Due to pragmatic restrictions, data for **papers II** and **III** were gathered from 16 school classes. This was a tradeoff between including more schools or allowing for an in-depth level of investigation of several dimensions studied and collecting data from different data sources for 16 schools only. However, future research could benefit from conducting a larger study including more schools.

Since this was out of scope for this thesis, the results of this PhD do not allow for a conclusion about whether the studied contextual factors had stronger or weaker associations with the individual implementation components of reach, dose delivered, dose

received, and fidelity. However, this could be an interesting aspect to pursue in future research.

Comparing implementation studies is complicated since inconsistencies exist in the way implementation is measured^{53, 69, 75, 81, 82}. This may be a result of a lack of agreement about the underlying theoretical definitions, or can reflect the differences in content, duration and aims of physical activity promoting programs, thus requiring different definitions and measurements of implementation. However, although this would be difficult to do, future research could certainly benefit from studying the validity of the different implementation components used in the field of implementation, and to develop a comparable and more standardized way of measuring implementation.

Finally, studying implementation is a first step, but future studies are needed to reveal the possible link between implementation level and effectiveness of school-based physical activity programs on, for example, students' health beliefs and/or health behaviour.

Chapter 7 References

7. References

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Chapter 8 Appendices

Appendix 1: Program materials

The AAYR (2017) teaching materials: Frisbee (A), class poster/board game (B), student scorecard (C), parent information (D) and teacher material/frisbee exercises (E):



Source of picture: University College South



The AAYR student scorecard:

The AAYR teaching materials: Main music video



Aktiv Året Rundt 2017 – Bliv Flyvende

Source of picture: University College South presented on YouTube

The AAYR teaching materials: Choreography video and 10 videos of frisbee tricks



Aldıv Året Rundt 2017 – Koreografi med musik

Source of picture: University College South presented on YouTube

Appendix 2: Transcription codebook

Everything said/done by the person is stated in (). Everything besides that is stated in [].

Characters which are	Meaning
to be inserted into the	
transcript	
[00:00]	Insert time indication approx. for every 5 minutes.
[?] [00:00]	The thing said is too unclear to be transcribed + state where
	in the interview
[? Text you think you can	The thing said is too unclear to be transcribed, but you have
hear is written here]	an idea of the meaning + state where in the interview
[00:00]	
A hesitation such as e.g. "uh" is written down	
=	Write = at the start of the sentence if the answer comes right
	after. E.g.
	Int: How big was it?
	15: = Way too big.
()	Shorter break
()	Longer break
U <u>He says</u>	Underlined – if emphasis on this word
?	Rising intonation
(cough)	Special expressions are marked in parenthesis, e.g. (cough) (laughter)
[]	Note down background noise such as [phone rings], [door opens]
[mad]	Write the tone in [] before the thing said, e.g. "Yes, it is [ironically] really important"
x-road [00:00]	Anonymize names, cities and roads, e.g. x-road
((word))	Double brackets indicated that U <u>you</u> U make a comment. E.g.:
	It is important that the children also learn that one should not
	get angry because there is one who has forgotten ((his
	scorecard)).
The respondent is stated as the number of the school (see example below)	
The file is saved as the number of the school + "teacher" + name of the person who	
conducted the interview. E.g. "School 16_Teacher_Julie"	
Commas as inserted for understanding, not for correct punctuation	
Abbreviations and numbers (under 100) are written as text	
The order of words is the same order as on the recording	
Repeated words are written down (write EVERYTHING that is said as it is, including	
words, sounds, non-verba	al communication such as laughter, breaks etc.
Appendix 3: Concept map



Note: The numbers in brackets (x/x) refers to the number of teachers who talked about the theme/number of references from these teachers.

Appendix 4: Characteristics of interviewed teachers

							Т	eac	her	•							
	Α	В	С	D	Е	F	G	Н	1	J	K	L	Μ	Ν	0	Р	Total
Gender																	
Male	Х		Х	Х	Х	Х									Х		6
Female		Х					Х	Х	Х	Х	х	Х	Х	Х		Х	10
Duration of																	
employment as																	
teacher																	
1-3 years				Х							х						2
4-6 years															х		1
7-9 years																	0
10-20 years		Х			Х	Х	х	Х		х		х	х	Х			9
21-30 years	Х		Х													Х	3
31 years or more									Х								1
Prior participation	Х	Х	Х	Х	Х	Х	х	Х	Х		х		Х	Х	х	х	14
in the program																	
Prior participation		Х	Х	Х	Х	Х	Х	Х	Х	Х			Х		Х	Х	12
in other health																	
programs for																	
school children																	
Subject																	
represented by																	
teacher																	
Danish	Х					Х	Х	Х	Х	Х	Х	Х		Х	Х	Х	11
Math		Х	Х	Х	Х								Х				5
Christianity	Х					Х	Х		Х	Х				Х			6
Music									Х							Х	1
History	Х			Х		Х	Х				Х	Х		Х	Х		8
English	Х				Х		Х	Х									4
Crafts and															Х	Х	2
design																	
Arts		Х	Х					Х		Х		Х				Х	6
Nature and		Х	Х	Х									Х				4
technology																	
Well-being									Х								1
Swimming							Х				Х						2
Physical	Х	Х	Х	Х	Х	Х	Х	Х		Х							9
education																	
Additional/further	Х	Х			Х		Х	Х			х		Х				7
education about																	
physical activity																	

Table: Characteristics of the interviewed teachers (n=16)

Appendix 5: Geographical placement of included schools



Source: Guldager et al⁹³

Appendix 6: Questionnaire for baseline student survey







Dear student

With this questionnaire, we ask you some questions about how you feel about your school, movement and physical activity.

This is how you fill out the questionnaire:

- 1. Read every question and all response categories before you answer and be cautious that you only one tick **one** box per question.
- 2. Some questions are easier to answer than others. If in doubt, tick the box that suits you the best. It is important that you answer all questions but if you find a question which you *cannot* answer or do not *want* to answer at all, then move on to the next question.
- 3. This is not a test so there are no right or wrong questions. We are really interested in finding out what *you* think so please answer the questions as honestly and precisely as you can.
- 4. You must *not* write your name on the questionnaire and it will only be the researchers from the University of Southern Denmark who will see your answers. Your friends, teacher, parents, school principal or others will *not* see your answers.

Enjoy and thank you for your help!

Identification

Here you must create your own codeword: (Own addition)

To be able to compare the answers you give in the questionnaire today with the answers you give when you fill out the questionnaire again in four weeks and again in six months, you must create your own codeword here:

In these two boxes, you must write the first two letters of your mothers first name.

(For example ME, if your mothers' name is Mette)

In these two boxes, you must write your date of birth.

(For example 2 and 3, if you were born on November 23rd or 0 and 1 if you were born on April 1st)

If you were born on November 23rd and your mothers' name is Mette, your entire code would be *ME23*, or if you were born on April 1st and your mothers' name is Mette, your entire code would be *ME01*.

1. Are you a boy or a girl?

- (1) 🛛 Boy
- (2) 🛛 Girl

Questions about your school

2.	What is the name of your school?)wn additio	n)		
3.	How do you feel about school at present? (Cu	rrie et. al,	2014)			
(1)	I like it a lot					
(2)	I like it a bit					
(3)	I don't like it very much					
(4)	I don't like it at all					
4.	How pressured do you feel by the schoolworl	k you have	to do? (0	Currie et. al, 2014)	
(1)	Not at all					
(2)	A little					
(3)	Some					
(4)	A lot					
5.	Here are some statements about the student	s in your cl	ass. Plea	se show how mu	ich you agr	ee or
	disagree with each one. (Currie et. al, 2014)					
(Ple	ease tick one box for each line)	Strongly	Agree	Neither agree	Disagree	Strongly
		agree		nor disagree		disagree
The	e students in my class enjoy being together.	(1)	(2)	(3)	(4)	(5)
Мо	st of the students in my class are kind and helpful.	(1)	(2)	(3)	(4)	(5)
Oth	er students accept me as I am.	(1)	(2)	(3)	(4)	(5)

6. Here are some statements about the teachers. Please show how much you agree or disagree with each one. ⁷⁵

(Please tick one box for each line)	Strongly	Agree	Neither agree	Disagree	Strongly
	agree		nor disagree		disagree
I feel that my teachers accept me as I am.	(1)	(2)	(3) 🗖	(4)	(5) 🗖
I feel that my teachers care about me as a person.	(1)	(2)	(3)	(4)	(5) 🗖
I feel a lot of trust in my teachers.	(1)	(2)	(3)	(4)	(5) 🗖

Questions about you and your family

In the following questions, you should respond from the FAMILY/HOUSEHOLD where you are the most. If you have several homes you chose one and answer form that in all questions.

- 7. Does your family own a car (car or van)? (Currie et. al, 2014)
- (1) 🛛 🗖 No
- (2) Yes, one car
- (3) **4** Yes, two or more cars
- 8. Do you have your own bedroom for yourself? (Currie et. al, 2014)
- (1) 🛛 🗖 No
- (2) 🛛 🖵 Yes
- 9. How many computers does your family own (including laptops and tablets/IPads, but *not* game consoles or smartphones)? (*Currie et. al, 2014*)
- (1) 🔲 None
- (2) 🛛 🖵 One
- (3) 🛛 Two

10. How many bathrooms (room with a shower/bathtub or both) are in your home? (*Currie et. al, 2014*)

- (1) 🔲 None
- (2) 🛛 🖵 One
- (3) 🗖 Two

11. Do you have a dishwasher at home? (Currie et. al, 2014)

- (1) 🛛 No
- (2) 🛛 Yes
- 12. DURING THE LAST 12 MONTHS: How many times did you and your family travel outside of Denmark? (*Currie et. al, 2014*)
- (1) **D** Not at all
- (2) Once
- (3) Twice
- (4) I More than twice

13. How rich is your family? (Currie et. al, 2014)

- (1) Uery rich
- (2) 🛛 Rich
- (3) Average
- (4) Door
- (5) Uery poor

14. In which country were your parents born? (Own addition)

(Please tick one box for each line)

	In Denmark	In another country	Don't know
My mom is born in	(1)	(2)	(3)
My dad is born in	(1)	(2)	(4)

Please check if you have answered all the questions

Did you create your own codeword on the top of page 2? If not – do so now. Thank you for your answers!

Appendix 7: Questionnaire for follow-up student survey

Questions about the campaign Active All Year Round (Own addition)

The last three weeks before the fall-vacation you school-class participated in a campaign called Active All Year Round. The next questions are about what you did during those three campaign weeks.

15. To which degree.....

(Please tick one box for each line)	Not at all	To a small degree	To some degree	To a high degree	To a very high degree
did you participate in the activities the class did related to the campaign <i>during school-hours</i> ?	(1)	(2)	(3)	(4)	(5)
did you use the frisbee related to the campaign during school-hours?	(1)	(2)	(3)	(4)	(5)
did you use the frisbee in relations with the campaign <i>at home</i> ?	(1)	(2)	(3)	(4)	(5)
did your family use the frisbee related to the campaign?	(1)	(2)	(3)	(4)	(5)
did you see the music video with Sebastian Klein and Jakob Riising related to the campaign during school-hours?	(1)	(2)	(3)	(4)	(5) 🗖
did you dance to the music video with Sebastian Klein and Jakob Riising related to the campaign during school-hours?	(1)	(2)	(3)	(4)	(5) 🗖
did you see the music video with Sebastian Klein and Jakob Riising related to the campaign during school-hours?	(1)	(2)	(3) 🗖	(4)	(5) 🗖
did you dance to the YouTube video with the choreography to the music video related to the campaign <i>during school-hours</i> ?	(1)	(2)	(3)	(4)	(5) 🗖
did you see the YouTube video with "10 cool Frisbee Tricks" related to the campaign during school-hours?	(1)	(2)	(3) 🗖	(4)	(5) 🗖
did you use the frisbee to do some of the "10 cool Frisbee Tricks" related to the campaign during school-hours?	(1)	(2)	(3)	(4)	(5)
did you fill out your activity folder / scorecard?	(1)	(2) 🗖	(3) 🗖	(4)	(5) 🗖
were you more physically active <i>during school- hours</i> during the campaign, than you usually are?	(1)	(2)	(3)	(4)	(5)
were you more physically active <i>during your free-</i> <i>time</i> during the campaign, than you usually are?	(1)	(2)	(3)	(4)	(5)
did you more often come <i>to</i> school by walking or biking during the campaign, than you usually do?	(1)	(2)	(3)	(4)	(5)

16. To which degree......

(Please tick one box for each line)	Not at all	To a small degree	To some degree	To a high degree	To a very high degree
did you like to participate in the campaign?	(1)	(2)	(3) 🗖	(4)	(5)
did you think it was boring to participate in the campaign?	(1)	(2)	(3)	(4)	(5)
did you understand what you should do in the activities related to the campaign?	(1)	(2)	(3)	(4) 🗖	(5) 🗖
did you think it was fun to participate in the campaign?	(1)	(2)	(3)	(4)	(5)
did you think it was strange to participate in the campaign?	(1)	(2)	(3)	(4)	(5) 🗖

Appendix 8: Correlation between implementation components

	Reach		Dose delivered		Dose r	eceived	Fidelity	
	r	р	r	р	r	р	r	р
Reach	1	.000	.29	.000	.44	.000	.23	.000
Dose delivered			1	.000	.31	.000	.58	.000
Dose received					1	.000	.38	.000
Fidelity							1	.000

Table 5: Correlations between implementation components (n = 226 - 268)