A Danish pilot study investigating effects of a psychosexual training program for adolescents with Autism Spectrum Disorder
Preface

This Master’s thesis tests the effect of a Dutch invented training program; Tackling Teenage Training, in a Danish context. The thesis is based on both primary and secondary data collected as part of a pilot study conducted at Center for Autism. The choice of research method for the pilot study include quantitative data collection tools assessing psychosexual knowledge, self-concept and problems with sexual behaviour in adolescents (12-17 years old) without offensive sexual behaviour, of average or above average intelligence and with Autism Spectrum Disorder in Denmark. The idea for this thesis was inspired by Center for Autism, and in cooperation with Lennart Pedersen, Jens Christiansen and Karen Bøtkjær the aim this thesis was formulated.

Acknowledgements

Firstly, I would like to thank my external project supervisors post.doc in psychology Jens Christiansen, psychologist Karen Bøtkjær, social educator Vibe Neidhardt and chief psychologist Lennard Pedersen at Center for Autism, for giving me the opportunity to take part in the research project Tackling Teenage Training of adolescents with ASD. I am grateful for have been given the responsibility to train three adolescents with ASD in the full TTT curricular; carry out ongoing communication and providing feedback to their parents; obtain data from the three adolescents and their parents at baseline and post-training as well as reminding other participants to fill-in questionnaires; collect and enter all data from non-automated tests and questionnaires needed for this thesis; assist in quantitative parent and adolescent evaluations of the TTT programme; develop and distribute an online psychosexual knowledge test in Survey Xact to several secondary schools and high schools; and finally assist in project managing e.g. ensure and follow up on criteria on time and quality. These practical tasks have given me valuable experiences, skills, and insight in scientific research in the field of psychology, sexual health and autism spectrum disorder from which I have learned a lot and I would not be without. I am much obliged for all your time and interesting professional discussions, for sharing your clinical and research experiences with me, for helping me out with practicalities and for supporting and encouraging me throughout this process. I look forward to future collaboration.
Secondly, I like to thank my academic main supervisor Cand.Psych.Aut., Ph.D Gert Martin Hald and assistant supervisor professor Siri Tellier (Copenhagen University), for the enthusiasm you have shown for my work, your ideas and feedback.

Last but not least, I want to thank my family, beloved partner Christian and dear friend Tia, for listening, being supportive, and proud of my accomplishments.
Abstract

Objective: Autism spectrum disorder (ASD) is perceived to be a major global health concern, not limited to the Western world, as it transcends cultural, geographic, and ethnic boundaries. Difficulties in coping with change is common among people with ASD and may consequently cause increased problems in the transition from childhood to adolescence. Several studies reveal that adolescents with ASD have equal sexual needs, but lack psychosexual knowledge and social skills to fulfil these needs, compared to typically developed peers. Therefore, adolescents with ASD often only have few intimate and sexual experiences, and expresses sexual frustration and sexual preoccupations. These factors can increase the risk for adolescents with ASD to develop or become victim of inappropriate sexual behaviour. This study aims to examine the effect of the Tackling Teenage Training intervention program on the participants’ psychosexual knowledge, self-concept and psychosexual problems.

Method: A total of 30 cognitively able adolescents with Autism spectrum disorder (ASD), aged 12-17 years old, were selected to an intervention condition. The outcomes were assessed using self-report as well as parent-report questionnaires at baseline (T1), posttreatment (T2; after 6 months), and follow-up (T3; after 12 months).

Results: Finding of this study show a strong primary outcome effect, which validates the TTT intervention program. Thus, the study found a statistical significant increased level of psychosexual knowledge from T1 (M = 21.2, SD = 8.8) to T2 (M = 30.4, SD = 4.1, p = 0.001, two-tailed), and from T1 to T3 (M = 31.2, SD = 3.9, p < 0.0005, two-tailed), but not from T2 to T3. Second, it is concluded from the findings, that the secondary outcome, level of positive self-concept, statistical significantly increased in the participants from T1 (M = 44.0, SD = 8.2) to T2 (M = 50.3, SD = 8.8, p = 0.010, two-tailed), but not from T2 to T3, and T1 to T3. Third, findings from this study, indicate that the level of sexual behaviour problems in the participants decreased from T1 to T3.

Conclusion: The effect of the Tackling Teenage Training program in 12-17 years-old adolescents with ASD in a Danish context, is increased level of psychosexual knowledge, increased level of positive self-concept and decreased level of sexual behaviour problems.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADI</td>
<td>Autism Diagnostic Interview - Revised</td>
</tr>
<tr>
<td>ADOS</td>
<td>Autism Diagnostic Observation Schedule - 2</td>
</tr>
<tr>
<td>APA</td>
<td>American Psychological Association</td>
</tr>
<tr>
<td>ASD</td>
<td>Autism Spectrum Disorder</td>
</tr>
<tr>
<td>CBCL</td>
<td>Child Behaviour Check List</td>
</tr>
<tr>
<td>CFA</td>
<td>Center for Austism</td>
</tr>
<tr>
<td>DSM</td>
<td>Diagnostic and Statistical Manual of Mental Disorders</td>
</tr>
<tr>
<td>MeSH</td>
<td>Medical Subject Headings</td>
</tr>
<tr>
<td>PKS</td>
<td>Psychosexual Knowledge Score</td>
</tr>
<tr>
<td>PKT</td>
<td>Psychosexual Knowledge Test for adolescents</td>
</tr>
<tr>
<td>RIAS</td>
<td>Reynolds Intellectual Assessment Scales</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>SDGs</td>
<td>Sustainable Development Goals</td>
</tr>
<tr>
<td>SRS</td>
<td>Social Responsiveness Scale</td>
</tr>
<tr>
<td>TD</td>
<td>Typically developing</td>
</tr>
<tr>
<td>ToM</td>
<td>Theory of Mind</td>
</tr>
<tr>
<td>TTI</td>
<td>Teen Transition Inventory</td>
</tr>
<tr>
<td>TTT</td>
<td>Tackling Teenage Training</td>
</tr>
<tr>
<td>T1</td>
<td>Baseline assessment prior to TTT training program</td>
</tr>
<tr>
<td>T2</td>
<td>Post-training assessment post TTT training program</td>
</tr>
<tr>
<td>T3</td>
<td>Six months’ follow-up assessment post TTT training program</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
</tbody>
</table>
# Table of contents

**PREFACE** ......................................................................................................................... 2  
**ACKNOWLEDGEMENTS** ................................................................................................. 2  
**ABSTRACT** ......................................................................................................................... 2  
**ABBREVIATIONS** ............................................................................................................. 4  

## 1.0 INTRODUCTION ........................................................................................................... 8  
1.1. Disability as a Global Health Concern ........................................................................ 8  
1.2. Epidemiology of Autism Spectrum Disorders .......................................................... 10  
1.3. The research problem .................................................................................................. 12  
1.4. Tackling Teenage Training Intervention .................................................................... 14  
1.5. Research objectives ...................................................................................................... 15  
1.5.1. Operationalization .................................................................................................. 15  
1.6. Literature review .......................................................................................................... 16  
1.6.1. Search method ....................................................................................................... 16  
1.6.2. Inclusion criteria ..................................................................................................... 18  
1.6.3. Literature search and flow-diagram of final literature .......................................... 19  
1.6.4. Literature review .................................................................................................... 22  

## 2.0 BACKGROUND: AUTISM SPECTRUM DISORDER ................................................ 27  
2.1. Definition of Autism Spectrum Disorder ..................................................................... 27  
2.2. History of Autism ........................................................................................................ 27  
2.3. Prognostic and Risk Factors ........................................................................................ 28  
2.4. Symptoms .................................................................................................................... 29  
2.5. Diagnostic Criteria ....................................................................................................... 29  
2.6. Functional Consequences ............................................................................................ 29  
2.7. Sex Differences ............................................................................................................ 29  
2.8. Comorbidities .............................................................................................................. 30  

## 3.0 THEORETICAL FRAMEWORK ............................................................................... 30  
3.1. Wing’s Triad of Impairment ....................................................................................... 30  
3.1.1. Socialisation ........................................................................................................... 31  
3.1.2. Communication ...................................................................................................... 32  
3.1.3. Imagination ............................................................................................................. 32  
3.2. Theory of Mind Deficit ............................................................................................... 33  

## 4.0 METHODS .................................................................................................................... 33  
4.1. Study design ................................................................................................................. 33  
4.1.1. Setting ..................................................................................................................... 34  
4.1.2. Sampling method ................................................................................................... 35  
4.1.3. Recruitment of participants .................................................................................. 36  
4.1.4. Screening and selection of participants .................................................................. 37  
4.1.5. Multiple reporters .................................................................................................. 39  
4.2. Intervention procedure ................................................................................................. 39  
4.3. Quality assurance ......................................................................................................... 40  
4.4. Intervention .................................................................................................................. 40  
4.5. Ethical considerations ................................................................................................. 42  
4.5.1. Ethical approval ...................................................................................................... 42  
4.5.2. Ethical principles ..................................................................................................... 42
4.6 SCREENING INSTRUMENTS ................................................................. 44
4.6.1 Social Responsiveness Scale (SRS) ........................................... 44
4.6.2 Reynolds Intellectual Assessment Scales (RIAS) ...................... 45
4.7 DIAGNOSTIC INSTRUMENTS ....................................................... 46
4.7.1 Autism Diagnostic Observation Schedule-2 (ADOS-2) .............. 46
4.7.2 Autism Diagnostic Interview-Revised (ADI-R) ......................... 47
4.8 TESTS .......................................................................................... 47
4.8.1 Psychosexual Knowledge Test (PKT) ....................................... 47
4.8.2 The Beck Self-Concept Inventory for Youth (BSCI-Y) ............... 48
4.8.3 Child Behaviour Checklist (CBCL) .......................................... 48
4.8.4 Teen Transition Inventory (TTI): ............................................. 48
4.9 PARTICIPANT FLOW AND BASELINE CHARACTERISTICS ...... 49
4.9.1 Adolescents with ASD ............................................................. 50
4.9.2 Typical developed peers ......................................................... 51

5.0 ANALYSIS .................................................................................... 52
5.1 BACKGROUND VARIABLES ...................................................... 52
5.2 OUTCOME VARIABLES ............................................................ 52
5.2.1 Hypotheses ........................................................................... 52
5.2.2 Choice of statistical tests ....................................................... 53

6.0 FINDINGS ..................................................................................... 57
6.1 BACKGROUND VARIABLES ...................................................... 57
6.1.1 Specific age .......................................................................... 57
6.1.2 RIAS ...................................................................................... 59
6.1.3 ADOS-2 .............................................................................. 60
6.1.5 SRS ...................................................................................... 62
6.2 OUTCOME VARIABLES ............................................................ 64
6.2.1 Psychosexual knowledge ....................................................... 64
6.2.2 Self-concept ......................................................................... 69
6.2.3 Sexual behaviour problems .................................................. 73
6.3 SOME THOUGHTS ON MULTIPLE TESTING .............................. 74

7.0 DISCUSSION ............................................................................... 75
7.1 STATEMENT OF PRINCIPLE FINDINGS ...................................... 76
7.2 STRENGTHS AND WEAKNESSES OF THE STUDY ................. 76
7.2.1. Strengths ........................................................................... 76
7.2.2. Weaknesses ....................................................................... 77
7.3 STRENGTHS AND WEAKNESSES IN RELATION TO OTHER STUDIES 79
7.4 MEANING OF THE FINDINGS ON SEXUAL BEHAVIOUR PROBLEMS 80
7.5 SUGGESTIONS FOR FUTURE RESEARCH ..................................... 80

8.0 CONCLUSION AND GLOBAL HEALTH PERSPECTIVES .................. 81

9.0 REFERENCES ............................................................................ 83
1.0 Introduction

1.1. Disability as a global health concern

Global estimates by WHO indicate that a large and growing number of the World’s population, approximately one billion people, live with disability or will experience some sort of disabilities during their lifetime, of whom a larger proportion lives in low- and middle-income countries. People with disabilities is a vulnerable group of particular global health concern, as they often face discrimination, stigma and barriers that restrict them from participating in society on an equal basis (WHO 2015, p.31).

Globally, adolescents with disabilities often lack psychosexual knowledge. One cause of this problem is that adolescents with disabilities are more likely to be excluded from sex education programmes (WHO 2016b). In some cases, they might have to rely on others to access sexual health programs or products, which can be a barrier if their caregivers do not want to acknowledge the sexual needs or interests of the adolescent (WHO/World Bank 2011, p.32). Especially, young females with invisible disabilities are vulnerable, as they are largely excluded from sexual and reproductive health services, mainstream education and information (UNFPA, 2016). In relation, females with disabilities are up to three times more likely than non-disabled females to be victims of physical, emotional and sexual abuse (WHO 2009, pp.6, 10–11). Moreover, it is common finding that existing materials or resources targeting sexual and reproductive health and rights (SRHR) for adolescents with disabilities are lacking. The unmet need includes information and communication materials e.g. in simple language and pictures, as well as provision of multiple sessions to address the content, which is not always accessible at the learning institutions (WHO 2009).

International legal framework addressing the unmet needs of adolescents with disabilities include the United Nations Convention on the rights of persons with disability (UN CRPD; UN General Assembly 2007), which was the first human rights treaty of its kind. Article 25 on Access to Health Services, is one out of five articles relating to sexual and reproductive health and rights (SRSR) and gender-based violence stressing the following:

“Provide persons with disabilities with the same range, quality and standard of free or affordable health care and programs as provided to other persons, inclusive in the area of sexual and reproductive health and population-based public health programs” (UN General Assembly 2007, Art. 25, p.15).
Thereby, the human rights for people with disabilities emphasize equity in SRHR.

Later, the 2030 Agenda for Sustainable Development (UN General Assembly 2015) got adopted by all UN Member States. The 2030 Agenda include both the economic, social and environmental dimensions of sustainable development, and aim to realise the human rights of all, to achieve gender equality and to empower all women and girls. The Agenda includes 17 universal Sustainable Development Goals (SDGs) and 169 targets with 231 global indicators, which build on the Millennium Development Goals (MDG’s) and seek to complete what they did not achieve (UN General Assembly 2007, p.1). Differently from the MDG’s, the Declaration, SDG’s and follow-up and review section of the 2030 Agenda is disability sensitive. First of all, paragraph 19 of the Declaration state the impotence of the Universal Declaration of Human Rights, and emphasise the responsibility of all states to respect, protect and promote human rights and fundamental freedoms for all, including disabled people (UN General Assembly 2015, p.6). Secondly, paragraph 23 of the Declaration refers to both youth and persons with disabilities when stating that people who are vulnerable must be empowered (UN General Assembly 2015, p.7):

“People who are vulnerable must be empowered. Those whose needs are reflected in the Agenda include all children, youth, persons with disabilities (of whom more than 80 per cent live in poverty).” (UN General Assembly 2015, paragraph 23. p.7).

This paragraph is of special interest, as it demands the empowerment of “vulnerable” people including persons with disabilities, and thereby places disabled people at the centre of poverty eradication throughout the entire Agenda. This means that whenever “vulnerable” is referred to throughout the entire Agenda (18 times), these provisions directly apply to persons with disabilities. Thirdly, paragraph 25 commit to provide inclusive and just quality education at all levels, and emphasize that all people, inclusive youth and people with disabilities should have access to life-long learning opportunities (UN General Assembly 2015, p.7). In addition, persons with disabilities are mentioned indirectly in SDG goal 3 addressing healthy lives and well-being for all at all ages, and directly in other targets on education (4.5 and 4.a), social, economic and political inclusion (10.2), sustainable cities (11.7), and equity monitoring (17.18). More of the SDG’s are related to the UN CRPD, e.g. SDG goal 4 links to UN CRPD 24 on right to inclusive education.

The two international legal frameworks, the UN CPRD and the 2030 Agenda, constitute a strong foundation for striving to combat the unmet needs of “persons with disabilities”, which is an
umbrella term including those who have long-term physical, mental, intellectual or sensory impairments (UN General Assembly 2007, p.4). In this study, Autism Spectrum Disorder (ASD) is specifically selected for further research.

1.2 Epidemiology of Autism Spectrum Disorders

According to The World Health Organization (WHO) epidemiological studies estimate the global prevalence rate of ASD and subsequent disability to be 1 in every 160 people worldwide (about 0.6%) (WHO 2013; WHO 2016a). However, this average figure differs largely from the most recent estimations of the global prevalence rate of ASD reported by both The American Psychiatric Association (APA) and Centre for Disease Control and Prevention, which unanimously estimate the prevalence rate to constitute about 1.00 percent of the total global population and about 1.13 percent of children world-wide, respectively (APA 2013; Autism and Developmental Disabilities Monitoring Network Surveillance Year 2008 Principal Investigators & Centers for Disease Control and Prevention 2012; Joseph et al. 2016).

Based on WHO’s estimated global prevalence rate, ASD is contributing to 7.6 million disability adjusted life years and approximately 0.3 percent of the global burden of disease (WHO 2013; WHO 2016a). However, most research into the epidemiology and other areas of autism is based on studies in high-income countries. This is the case even though less than 20 percent of the world’s current population live in these countries (Durkin et al. 2015). Therefore, low- and middle-income countries have been largely underrepresented in autism research. As a result, the prevalence of ASD in many low- and middle-income countries is unknown and the global burden of disease is currently underestimated (Durkin et al. 2015; Elsabbagh et al. 2012).

For instance, a systematically review of published literature on ASD in sub-Saharan Africa show that only one study aimed at documenting the prevalence of ASD (Abubakar et al. 2016). In this study, the authors reported unadjusted prevalence for ASD to be 6.8 per 1000 children aged 2-9 years (about 0.68%) in the Kampala District, Uganda (Abubakar et al. 2016; Kakooza-Mwesige et al. 2014).

In Asia estimates of ASD prevalence vary widely across time and country (China: 0.003–0.17%, Japan: 0.011–0.21%, South Korea: 1.89%) (Kim et al. 2011; Rudra et al. 2017). According to
Elsabbagh et al. (2012), population-based studies in Asia since 2000 establish a median observed prevalence of 1.39 per 1,000 individuals (about 0.14 %) (Elsabbagh et al. 2012; Rudra et al. 2017). However, the first comprehensive study using a total population sample of South Korean children aged 7-12 years estimated the autism prevalence rate to be approximately 1 in 38 children (about 2.64%). The sample included about 55,000 children enrolled in general education schools, special education and the disability registry and were systematically assessed by use of multiple clinical evaluations. Even though the estimated autism prevalence rate was by far higher than any other population in the world, the study does not suggest that South Koreans have more autism than other populations, but that autism is under-diagnosed and under-reported (Kim et al. 2011). Changing definition of ASD, diversity of screening and diagnostic instruments, and variety of study designs can potentially account for some of the variance in estimated prevalence (Elsabbagh et al. 2012; Kim et al. 2011; Rudra et al. 2017). Therefore, the study by Kim et al. (2011) suggests rigorous screening, translation and adaptation of the gold-standard diagnostic instruments (i.e. ADOS and ADI-R), and use of total population sample-based research methods especially in previously understudied, non-clinical populations (e.g. India, South Africa, Mexico and Taiwan), in order to produce more accurate ASD prevalence estimates world-wide (Kim et al. 2011).

In the United States the overall estimated ASD prevalence was assessed in 11 Autism and Developmental Disabilities Monitoring (ADDM) Network sites every two years during 2000-2012. In 2012, the estimated ASD prevalence in children aged 8 years was 14.6 per 1,000 children (range 8.2-24.6 per 1,000 children) or approximately 1 in 68 (about 1.5%) (Christensen et al. 2016). Nevertheless, this overall prevalence cannot be generalized to all children aged 8 years in the United States’ population due to the representativeness of the sample (Christensen et al. 2016).

Based on epidemiological studies conducted over the past 50 years, the prevalence of ASD appears to be increasing globally. This upward trend in prevalence rates has been attributed to several factors such as improved widespread awareness and recognition of ASD, better diagnostic tools and improved reporting (WHO 2016a; Joseph et al. 2016). In addition, a study in California show that the prevalence of people diagnosed with learning disabilities have declined over the years from 1987 to 1994, corresponding to the increased prevalence of autism (Croen, Grether, Hoogstrate, & Selvin, 2002; Frith & Sofie Hauch Winiarczyk, 2010, p. 47). Nevertheless, findings by Maenner et al. (2014) show that, in the future, ASD prevalence estimates will likely be lower under the use of
the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; APA 2013) diagnostic criteria compared to the previous DSM-IV-TR (Maenner et al. 2014). This is supported by a systematically review by Smith, Reichow & Volkmar revealing that, from the majority of 25 included studies, only 50-70 percent of individuals will maintain qualified for the ASD diagnosis by the DSM-5 diagnostic criteria (Smith et al. 2015).

In conclusion, ASD is a major global health concern, not limited to the Western world, as it transcends cultural, geographic, and ethnic boundaries. Though, it is possible that cultural factors may impact diagnostic practices and prevalence estimates (Kim et al. 2011; Rudra et al. 2017).

1.3 The research problem

Adolescence may be the most challenging of developmental stages as it impacts both the social, physical, and emotional areas of adolescents’ life (Koller 2000). Difficulties in coping with change is common among people with ASD and may consequently cause increased problems in the transition from childhood to adolescence (Visser et al. 2015; APA 2013). Adolescents with ASD usually mature physically and sexually according to normal developmental stages. Even though an adolescent with ASD develop normally in some areas, it can face difficulties in social understanding and interactions, which can cause confusion to the adolescent and the parents (Koller 2000).

Many adolescents with ASD experience high levels of stress during puberty due to their inability to understand and meet social demands. They are also at increased risk of being bullied and socially isolated as a consequence of their social impairments (Balfe & Tantam 2010; Humphrey & Lewis 2008). Moreover, because children with ASD view approval by peers with the same importance as typically developing (TD) children, they are more likely to have low self-esteem and suffer from depression and anxiety in adolescence (Koller 2000; Vickerstaff et al. 2007; Williamson et al. 2008).

Several studies reveal that adolescents with ASD have equal sexual needs, but lack knowledge regarding sexuality and social skills to fulfil these needs, compared to TD peers (Dekker et al. 2015; Dewinter et al. 2013; Visser et al. 2015; Mehzabin & Stokes 2011; Henault 2006). A recent review by Beddows & Brooks (2015) indicates that lacking knowledge can lead to inappropriate sexual
behaviour characterised by hyper-masturbation, public masturbation, inappropriate romantic gestures, inappropriate arousal and exhibitionism (Beddows & Brooks 2015). These behaviours may likely be caused by lack of understanding of their physical and emotional development, due to absence of targeted and appropriate sexuality education, less information about sexuality received from their peers due to few friendships, and the severity of their diagnosis (Beddows & Brooks 2015; Dekker et al. 2015; Bauminger & Kasari 2000). Therefore, adolescents with ASD often only have few intimate and sexual experiences, and expresses sexual frustration and sexual preoccupations (Visser et al. 2015; Ray et al. 2004). These factors can increase the risk for adolescents with ASD to develop or become victim of inappropriate sexual behaviour, like touching others inappropriately, stalking, public masturbation, sexual victimisation and sexual coercion (Visser et al. 2015; Stokes et al. 2007; Henault 2006).

In order to prevent potential inappropriate sexual behaviours in adolescents with ASD, current literature emphasise the need for guidance of adolescents with ASD in stimulating healthy psychosexual development (Dekker et al. 2015; Nichols & Blakeley-Smith 2009; Gougeon 2010; Henault 2006). Healthy psychosexual functioning requires specific knowledge and skills in all domains including sexual behaviour, sexual selfhood, and sexual socialization. Extensive education in related issues such as personal hygiene, developing and maintaining relationships, recognizing and acknowledging personal boundaries, and intimacy and sexual activity (with or without partners) are important to stimulate healthy psychosexual functioning (Dekker et al. 2015; Beddows & Brooks 2015). Beddows and Brooks (2015) advises that individualized, repetitive and structured education in an accessible form should be provided from an early age. This education should include training of social skills and knowledge on puberty, before more technical aspects of sexuality education are taught (Beddows & Brooks 2015). In order to make the psychosexual education accessible for adolescents with ASD, Ray et al. (2004) suggests fragmentary structured and visually presented information instead of providing all information at once, use of concrete descriptions rather than abstract concepts, and use of ordered lists and labels when presenting terms (Ray et al. 2004).

Based on current evidence, an individual training program has been developed in the Netherlands, aiming for a positive psychosexual development in adolescents with ASD: The Tackling Teenage Training (TTT) program (Boudesteijn et al. 2012).
1.4 Tackling Teenage Training intervention

The TTT program is a psychosexual intervention targeting adolescents with ASD aged 12-18 years old with a full intelligence ability quotient (IQ) score of 85 or higher (Visser et al., 2015). The program addresses issues related to tackling difficulties that may be of specific difficulty for intellectual able adolescents with ASD regarding all domains of psychosexual functioning, including sexual behaviour, sexual selfhood and sexual socialisation, with particular focus on obtaining theoretical and practical knowledge (Dekker et al. 2015; Visser et al. 2017). Hence, the TTT program offer guidance and support by providing psychosexual knowledge and related skills (Dekker et al. 2015).

A pilot study of the effect of the TTT program on psychosexual knowledge in a sample of 11-19 years-old adolescents with ASD (n = 30) in the Netherlands, showed that the TTT program had a causal effect on the overall knowledge of puberty and psychosexual topics (tested by a knowledge test, score 0-37), which significantly increased from pre-training (M = 25.80, SD = 6.30) to post-training (M = 33.80, SD = 2.72, p < 0.001) (Dekker et al. 2015). In particular, the study showed that psychosexual knowledge regarding sexual selfhood (i.e. sexual preferences), and sexual behaviour (i.e. practical knowledge) increased by 40 percent among all participants during the TTT program, and 35 percent of the questions (total of 37) was answered correctly by all adolescents after participating in the TTT program, compared to only three percent at baseline (Dekker et al. 2015; Visser et al. 2017). In addition, the first randomised controlled trail (RCT) by Visser et al. (2017) revealed that parents of 12-18 years-old adolescents (n = 189) with ASD in the Netherlands, reported their children to have more insight in interpersonal boundaries in social and intimate situations (Visser et al. 2017).

Furthermore, the pilot study by Dekker et al. (2015) shows, perhaps not surprisingly, that after following the TTT program, age of the adolescent correlates positively with psychosexual knowledge (r = -0.55, p < 0.01) (Dekker et al. 2015). Accordingly, the younger the age of the adolescent, the larger the size of a possible change in psychosexual knowledge, that can be obtained over the course of the TTT program. In addition, the newly published RCT by Visser et al. (2017), confirmed that especially younger adolescents with ASD benefitted more from the TTT program than older adolescents. These findings are supported by other studies which have showed that psychosexual knowledge increases most between the age of 11-14 (Winn et al. 1995; Visser et al.
Therefore, the TTT programme might show the most optimal outcome regarding psychosexual knowledge in relatively young adolescents. Though, due to the low number of girls who participated in the pilot study, these finding cannot be generalised to females (Dekker et al., 2014).

Knowledge, perceptions and motivations in relation to sexual activity and contraception, are important predictors of contraceptive use (Ryan et al. 2007; Dekker et al. 2015). Despite, only few studies have investigated if psychosexual knowledge improves decision making regarding sexual behaviour in adolescents with ASD (Beddows & Brooks 2015). The RCT by Visser et al. (2017) investigated the effects of the TTT program in preventing problematic sexual behaviour in adolescents with ASD. The results showed a decrease in the reported sexual behaviour from baseline to post-training in all adolescents with ASD. Especially, parents of younger adolescents with ASD reported significantly improved social functioning after following the TTT program. Thereby, the RCT study contribute to the growing evidence promoting training in psychosexual topics of adolescents with ASD (Koller 2000; Nichols & Blakeley-Smith 2009; Visser et al. 2017). Moreover, it may likely be concluded that the TTT program lead to healthier decision making on psychosexual functioning in adolescents with ASD, which is supported by studies made in TD peers showing that psychosexual knowledge improves decision making regarding sexual behaviour (Ryan et al. 2007; Dekker et al. 2015).

Finally, a recent study by Escalona et al. (2016) showed significant increased psychosexual knowledge ($t = 2.03, p = 0.0001$) in 12-18 years-old Spanish adolescents with ASD ($n = 22$) after end TTT program. In line with the previously mentioned Dutch studies, a negative significant association was found between increased psychosexual knowledge after TTT training and age ($r = 0.50, p = 0.02$) as well as verbal IQ ($r = 0.51, p = 0.016$) (Escalona et al. 2016). Thereby, the TTT program seem to be effective on psychosexual knowledge and functioning in both Dutch and Spanish adolescents with ASD.

1.5 Research objectives

Based on the research problem, the main objective of this thesis is to investigate the following research question by using a pre- and post-training design:
What is the effect of the TTT program on the psychosexual functioning in adolescents (12-17 years-old) without offensive sexual behaviour, of average or above average intelligence and with ASD in Denmark?

The aims are first to investigate the effects of the TTT program for adolescents with ASD on cognitive outcomes (i.e. psychosexual knowledge and self-concept), second to assess the effect of the TTT program on behavioural outcomes (i.e. sex behaviour problems). Therefore, the sub-objectives of this quantitative study are:

1. To assess whether *psychosexual knowledge* in Danish adolescents with ASD significantly increase from T1 to T2, from T2 to T3 and from T1 to T3.
2. To measure whether the level of positive *self-concept* in Danish adolescents with ASD significantly increase from T1 to T2, from T2 to T3 and from T1 to T3.
3. To examine whether the level of *problems with sexual behaviour* in Danish adolescents with ASD significantly decrease from T1 to T3,

1.5.1 Operationalization

According to the DSM-5, ASD encompasses disorders otherwise referred to as early infantile autism, childhood autism, Kanner’s autism, high-functioning autism, atypical autism, pervasive developmental disorder not otherwise specified, childhood disintegrative disorder, and Asperger’s disorder (APA 2013).

1.6 Literature review

A systematic literature review was carried out in order to identify relevant literature in which psychosexual education was assessed in adolescents without offensive behaviour, of average or above average intelligence and with ASD.

1.6.1 Search method

The literature review was limited to evidence based scientific literature i.e. peer reviewed articles published in academic journals. The research question of this study is health scientific oriented towards both natural and humanistic science, under which the following academic subject areas are related; psychology, public health, biology, anatomy, physiology, medicine and biomedicine. According to the PRISMA guidelines (The Cochrane Collaboration 2011) for systematic reviews,
the following two applicable databases are selected; PubMed MEDLINE and PsycINFO. PsycINFO, from the American Psychological Association (APA), is chosen since it is a bibliography that contains a wide range of professional and academic literature in psychology and related disciplines. In addition, PubMed MEDLINE is selected due to the updated indexing of more than 56000 world-wide scientific journals of which citations and abstracts include the fields of biomedicine and health (NML 2017).

In PubMed MEDLINE, all keywords related to the research question were identified with the Medical Subject Headings (MeSH) vocabulary, to ensure all relevant words were included in the search. The search was carried out until July 2017 and the following search strategy was applied:

<table>
<thead>
<tr>
<th>Block</th>
<th>Keywords</th>
<th>Supplementary words (free text)</th>
<th>MeSH terms</th>
</tr>
</thead>
</table>
| #1    | TTT program | “Tackling teenage training” OR “TTT” OR (“psychosexual” AND “education”) OR “psycho-education” OR (“sex*” AND education”) OR (“sex*” AND “training”) | “Sexology”:
Def.: “This discipline concerns the study of SEXUALITY, and the application of sexual knowledge such as sexual attitudes, psychology, and SEXUAL BEHAVIOR. Scope of application generally includes educational (SEX EDUCATION), clinical (SEX COUNSELING), and other settings.” (NCBI 2004a).

“Education”:
Def.: “Acquisition of knowledge as a result of instruction in a formal course of study.” (NCBI 2017b).

“Education [Subheading]”:
Def.: “Used for education, training programs, and courses in various fields and disciplines, and for training groups of persons.” (NCBI 1967a).

“Patient education as topic”:
Def.: “The teaching or training of patients concerning their own health needs”. (NCBI 2008). |

AND |
| #2   | Psychosexual functioning | “Psychosexual selfhood” OR “psychosexual knowledge” OR “self-esteem” OR “self-concept” OR “psychosexual behaviour” OR “sexual | “Sexual behaviour”:

“Psychosexual development”:
Def.: “The stages of development of the psychological aspects of sexuality from birth to adulthood; i.e., oral, anal, genital, and latent periods.” (NCBI 1968). |
In order to specify the result of the search, Boolean operators such as "AND", "OR" or "NOT" was added to the searching strategy (Jesson et al. 2011, p.28; Glasdam & Beedholm 2015, p.39). "AND" creates an intersection, which narrows the search area, whereas "OR" creates an association quantity in order to enlarge the search area and “NOT” discard literature of which the content are not relevant for this study (Jesson et al. 2011, p.28; Glasdam & Beedholm 2015, p.39). The used combination of words in blocks and the use of Boolean operators are presented in Table 1.

### 1.6.2 Inclusion criteria

In the following section, considerations on quality assurance and evidence level are presented, as well as established exclusion criteria.
Inclusion criteria was established in order to ensure comparability of the final literature and the quality of this study. Firstly, the literature review is limited to peer reviewed articles from academic journals published in scientific databases from 2007-2017. This criterion is established to ensure the most recent articles of high scientific standard. However, articles were included without questioning its impact factor, as two articles might be of the same quality even though they are published in journals of different ranking (Jesson et al. 2011, p.23). Secondly, literature of high evidence level was preferred c.f. the evidence hierarchy (CEBM 2009). Nevertheless, study designs of lower ranking were included in order to uncover the examined study field. Thirdly, the literature review only involves English articles, as it is the most widely used written language in scientific literature of the last quarter of the century (Wallin & Lange 1999) and additionally is fully mastered by the author. Fourthly, to simplify the collection of relevant literature, inclusion criteria included abstract and available full text. Finally, the articles were only included if the content did correspond to the research question, i.e. addressing adolescents with ASD and psychosexual education.

In sum, the possibility of filtering in relation to language, study design, language, abstract as well as age group was used in the respective databases.

1.6.3 Literature search and flow-diagram of final literature

PubMed MEDLINE:

The block search strategy on MeSH terms in PubMed MEDLINE is presented in Table 2. Only 4 items occurred when limiting the search to include search string A c.f. Table 2. Thus, in order to expand the search, block 2 was left out in search string B (n = 70) leaving in total 70 items for further review (search string C) as there were four duplicates.

Table 2: Block search on MeSH terms in PubMed MEDLINE

<table>
<thead>
<tr>
<th>Block</th>
<th>MeSH terms</th>
<th>MeSH (n°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>&quot;Sexology&quot;[Mesh] OR (&quot;Education&quot;[Mesh] OR &quot;eduction&quot; [Subheading] OR &quot;Patient Education as Topic&quot;[Mesh])</td>
<td>731,323</td>
</tr>
<tr>
<td>#2</td>
<td>&quot;Sexual Behavior&quot;[Mesh] OR &quot;Psychosexual Development&quot;[Mesh]</td>
<td>107,734</td>
</tr>
<tr>
<td>#3</td>
<td>&quot;Adolescent&quot;[Mesh]</td>
<td>179,814</td>
</tr>
<tr>
<td>#4</td>
<td>&quot;Intellectual Disability&quot;[Mesh]</td>
<td>4,891</td>
</tr>
<tr>
<td>#5</td>
<td>&quot;Criminals&quot;[Mesh]</td>
<td>3,617</td>
</tr>
</tbody>
</table>
A flow diagram presenting the process of exclusion of the literature search is displayed in Figure 1. When filtering the search to include articles with abstracts, 67 items was identified and three items excluded. After adding the rest of the filters in concordance with the inclusion criteria (i.e. full text, 10 years, English, adolescent) the 67 identified items remained. Of these, 41 items were excluded after title scanning, leaving 26 articles for abstract reading. 11 articles were excluded in this process. Hence, 14 items were read full text leading to exclusion of another 7 articles. Finally, 7 articles from PubMed MEDLINE were identified as relevant to include in the literature review.

**Figure 1: Flow diagram of the identified articles from PubMed MEDLINE:**

<table>
<thead>
<tr>
<th>Block search C</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
</tr>
<tr>
<td>• Filter: abstract</td>
</tr>
<tr>
<td>67</td>
</tr>
<tr>
<td>• Filter: full text, 10 years, English, adolescents</td>
</tr>
<tr>
<td>26</td>
</tr>
<tr>
<td>• Relevant title</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>• Relevant abstract</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>• Relevant full text</td>
</tr>
</tbody>
</table>

**PsycINFO:**

The block search strategy on thesaurus terms in PsycINFO is presented in Table 3. Six items occurred when limiting the search to include search string A. Thus, in order to expand the search, block 2 was left out in search string B (n = 40 items), leaving in total 44 items for further review (search string C) as two items were duplicates.
Table 3: Block search on MeSH terms in PsycINFO

<table>
<thead>
<tr>
<th>Block</th>
<th>Treasures terms</th>
<th>Thesaurus terms (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>&quot;Sex*&quot; AND &quot;Education&quot;</td>
<td>10,310</td>
</tr>
<tr>
<td>#2</td>
<td>&quot;Sexual Behavior&quot; OR &quot;Psychosexual Development&quot;</td>
<td>62,040</td>
</tr>
<tr>
<td>#3</td>
<td>&quot;Adolescent&quot;</td>
<td>366,055</td>
</tr>
<tr>
<td>#4</td>
<td>&quot;Intellectual Disability&quot;</td>
<td>22,473</td>
</tr>
<tr>
<td>#5</td>
<td>&quot;Criminals&quot;</td>
<td>19,113</td>
</tr>
<tr>
<td>#6</td>
<td>&quot;Autism Spectrum Disorder&quot;</td>
<td>10,137</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Search string</th>
<th>Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>#1 AND #2 AND #3 NOT (#4 AND #5) AND #6</td>
</tr>
<tr>
<td>B</td>
<td>#1 AND #3 NOT (#4 AND #5) AND #6</td>
</tr>
<tr>
<td>C</td>
<td>#A AND #B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>total number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>32</td>
</tr>
<tr>
<td>C</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>10 items excluded</td>
</tr>
<tr>
<td>D</td>
<td>10</td>
</tr>
<tr>
<td>E</td>
<td>9</td>
</tr>
<tr>
<td>F</td>
<td>9</td>
</tr>
</tbody>
</table>

A flow diagram presenting the process of exclusion of the literature search is displayed in Figure 2. When filtering the search to include English articles published in academic journals from 2008-2017, 12 items was excluded and 32 items was identified. After filtering for articles with an adolescent study population aged 12-17 years old, 22 identified items remained and another 10 items was excluded. Of these, 11 items were excluded after title scanning, leaving 10 items for abstract reading. One item was excluded in this process. Hence, nine items were read full text leading to no additional exclusions. Therefore, 9 articles from PsycINFO were identified as relevant to include in the literature review.

Figure 2: Flow diagram of the identified articles from PsycINFO

```
+----------------------------------+
| 44 | Block search C                   |
|    |                                 |
| 32 | Filter: English, published 2008-2017, academic journals |
|    | 12 items excluded                |
| 22 | Filter: adolescents              |
|    | 10 items excluded                |
| 10 | Relevant title                   |
|    | 11 excluded due to the title     |
|  9 | Relevant abstract                |
|    | 1 excluded by reading abstract   |
|  9 | Relevant full text               |
|    | 0 excluded by reading full text  |
```
In Annex 1, the search strings applied in PubMed MEDLINE and PsycINFO are presented.

1.6.4 Literature review

*PubMed MEDLINE:*

The final seven studies from the search in PubMed MEDLINE are presented in Table 4. The studies vary in study origin, study design, age group, sample size and outcome measurement methods. Four studies were conducted in Europe (Ginevra et al. 2016; Gordon et al. 2015; Visser et al. 2015; Dekker et al. 2015) and three in USA (Curtis 2017; Lehan Mackin et al. 2016; Vernon et al. 2016) all published from 2015-2017. The age of the study populations span from 9-20 years with sample sizes from 6 to 269 adolescents or their parents. Four of the included studies tested the effect of an intervention, of which two addressed the same (i.e. the TTT program). For more detailed information on author, title, origin, aim, study type, age group studied, outcome(s), intervention and conclusion see the study protocol (Table 4).

In addition, the seven excluded is presented in Table 5. The majority (n = 6) of the articles were excluded due to lack of a psychosexual education element of the study (Divan et al. 2015; Hong et al. 2016; Kaboski et al. 2015; Laugeson et al. 2015; Okuno et al. 2016; Waugh & Peskin 2015). Moreover, in four of these articles the age group of the study population were irrelevant to this study (Divan et al. 2015; Laugeson et al. 2015; Okuno et al. 2016; Waugh & Peskin 2015). Lastly, the final study (Lyons et al. 2016) were excluded due to intellectual disability in the studied population.

*PsycINFO:*

The final nine studies from the search in PsycINFO are presented in Table 4 of which one was duplicated from the literature review in PubMed MEDLINE and will not be mentioned further. As in the previous review, studies vary in study origin, study design, age group, sample size and outcome measurement methods. Three studies were conducted in Europe (Beddows & Brooks, 2015; Dewinter, Vermeiren, Vanwesenbeeck, Lobbestael, & Van Nieuwenhuizen, 2015; Visser et al., 2017) and five in USA (Ballan & Freyer 2017; Corona et al. 2016; Holmes & Himle 2014; Laura G. Holmes et al. 2016; Laura G Holmes et al. 2016) all published from 2015-2017. The age of the study populations span from 11-19 years with sample sizes from 6 to 190 adolescents or their parents. Two of the included studies tested the effect of an intervention, of which one addressed the
TTT program. For more detailed information on author, title, origin, aim, study type, age group studied, outcome(s), intervention and conclusion see the study protocol (Table 4).

In total, the study protocol includes fifteen articles, which were used for background knowledge of this study. In order to expand the background knowledge further, the author additionally used the snowball method to include relevant literature which did not appear in this review.
<table>
<thead>
<tr>
<th>Author, year, title, country</th>
<th>Aim</th>
<th>Study type</th>
<th>Age group, n</th>
<th>Outcomes</th>
<th>Intervention</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballan &amp; Freyer 2017, Autism Spectrum Disorder, Adolescence, and Sexuality Education: Suggested Interventions for Mental Health Professionals, USA</td>
<td>To review three techniques for application in social skills components of sexuality education programs: Applied Behavior Analysis (ABA), Social Stories (SS), and Social Behavior Mapping (SBM).</td>
<td>Literature review</td>
<td>Adolescents</td>
<td>ABA, SS and SBM.</td>
<td>None</td>
<td>ABA has an empirical research base supporting its effectiveness for teaching individuals with ASD, but has NOT been extensively evaluated in the context of sexuality education. Likewise, SS and SBM have NOT been subject to empirical validation for use in sexuality education.</td>
</tr>
<tr>
<td>Beddows &amp; Brooks 2016, Inappropriate sexual behaviour in adolescents with autism spectrum disorder: what education is recommended and why, UK</td>
<td>To describe the type of inappropriate behaviour that occur in adolescents with ASD, explain the reason for such behaviours, suggest what education is suitable and identify current gaps in research.</td>
<td>Literature review</td>
<td>Adolescents</td>
<td>Type of inappropriate behaviour, causes of inappropriate behaviour and recommended education.</td>
<td>None</td>
<td>Sexual behaviours that occur in adolescents with ASD incl. e.g. hyper-masturbation and inappropriate romantic gestures, caused via a lack of understanding of normal puberty, inappropriate sex education, and the severity of their ASD. It is suggested that individualized, repetitive and accessible education should be started from an early age.</td>
</tr>
<tr>
<td>Corona et al. 2016, Providing Education on Sexuality and Relationships to Adolescents with Autism Spectrum Disorder and Their Parents, USA</td>
<td>To pilot and evaluate an intervention focused on providing sexuality and relationship education to adolescents with ASD and their parents.</td>
<td>Pilot study</td>
<td>12-16 years old (n = 6)</td>
<td>Sexual behaviour scale, adolescent knowledge scale, parent questionnaire, parent satisfaction questionnaire.</td>
<td>Six two-hour sessions program over the course of 3 months to provide education on sexuality and relationships.</td>
<td>Parents reported satisfaction with the program, and were discussing a greater number of topics with their adolescents after following the program.</td>
</tr>
<tr>
<td>Curtis, A. 2017, Why Sex Education Matters for Adolescents with Autism Spectrum Disorder, USA</td>
<td>To examine the best approach to prevent inappropriate behaviours and sexual victimization.</td>
<td>Viewpoint</td>
<td>Adolescents</td>
<td>None</td>
<td>None</td>
<td>Sex education for adolescents is important to forming romantic relationships, understanding bodies and boundaries, increasing personal safety, and avoiding legal trouble.</td>
</tr>
<tr>
<td>Dekker et al. 2015, Improving Psychosexual Knowledge in Adolescents with Autism Spectrum Disorder: Pilot of the Tackling Teenage Training Program, The Netherlands</td>
<td>To evaluate whether psychosexual knowledge increased after taking part in the Tackling Teenage Training (TTT) program, using a pre- and post-training design.</td>
<td>Pilot study</td>
<td>11-19 years old (n = 30)</td>
<td>Psychosexual knowledge</td>
<td>18 one-on-one sessions, 45-60 min. each, offering guidance and support with tackling difficulties with puberty and psychosexual functioning.</td>
<td>Preliminary findings indicate that the TTT program may be useful to improve psychosexual knowledge and functioning in adolescents with ASD.</td>
</tr>
<tr>
<td>Dewinter et al. 2015, Sexuality in adolescent boys with autism spectrum disorder: self-reported behaviours and attitudes, The Netherlands</td>
<td>To investigate sexual behaviours and attitudes in a group of adolescent boys diagnosed with ASD and with at least average intelligence.</td>
<td>Case-control study</td>
<td>15-18 old years (n = 50)</td>
<td>ADI-R, ADOS, sexual behaviour and attitude towards sexuality.</td>
<td>None</td>
<td>Sexuality is a normative part of adolescent development in high-functioning boys with ASD.</td>
</tr>
<tr>
<td>Ginevra et al. 2017, The differential effects of Autism and Down's syndrome on sexual behavior, Italy</td>
<td>To investigate sexuality in adolescents with ASD and Down's syndrome and to compare them with TD adolescents, by surveying their parents.</td>
<td>Cross-sectional study</td>
<td>11-18 years old (n = 269 parents)</td>
<td>Sexual Behavior Scale (social behaviour, privacy awareness, sex education, sexual behaviour and parental concerns about the child's behaviours).</td>
<td>None</td>
<td>Sig. improvement in knowledge of privacy and parental concerns with age for adolescents with ASD. The results obtained emphasize the need to train adolescents with ASD through sex education programs.</td>
</tr>
<tr>
<td>Gordon et al. 2015, A randomised controlled trial of PEGASUS, a psychoeducational programme for young people with high-functioning autism spectrum disorder, UK</td>
<td>To evaluate the intervention PEGASUS (Psychoeducation group for autism spectrum understanding and support) aiming to enhance the self-awareness of young people with ASD.</td>
<td>RCT</td>
<td>9-14 years old (n = 48)</td>
<td>Primary: self-awareness. Secondary: Rosenberg Self-Esteem Scale.</td>
<td>Six weeks’ group psychoeducational programme teaching young people with ASD about their diagnosis.</td>
<td>More general knowledge about ASD, greater awareness of collection of unique strengths and difficulties associated with ASD. Psychoeducation did not lower self-esteem. This RCT provides initial evidence for PEGASUS's efficacy as a psychoeducation programme for people with ASD.</td>
</tr>
<tr>
<td>Study</td>
<td>Title</td>
<td>Sample</td>
<td>Intervention</td>
<td>Outcomes</td>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>--------</td>
<td>--------------</td>
<td>----------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>Holmes &amp; Himle 2014.</td>
<td>Brief report: parent-child sexuality communication and autism spectrum disorders, USA</td>
<td>To examine sexuality communication patterns between parents and adolescents with both low and high functioning ASD.</td>
<td>Quantitative research design</td>
<td>12-18 years old (n = 190 parents)</td>
<td>SRS-2 and online sexuality survey (parent-report).</td>
<td>None</td>
</tr>
<tr>
<td>Holmes et al. 2016a.</td>
<td>Parental sexuality-related concerns for adolescents with autism spectrum disorders and average or above IQ, USA</td>
<td>To thoroughly examine the relationship between symptoms of ASD, parental sexuality and relationship-related concerns and parent-child sexuality communication of adolescent with ASD and intact intellectual functioning.</td>
<td>Quantitative research design</td>
<td>12-18 years old (n = 131 parents)</td>
<td>SRS-2, online sexuality survey (parent-report), Parental sexuality concern inventory (PSCI), and parental sexuality education inventory (PSEI).</td>
<td>None</td>
</tr>
<tr>
<td>Holmes et al. 2016b.</td>
<td>Parental romantic expectations and parent-child sexuality communication in autism spectrum disorders, USA</td>
<td>To examine the relationship between overall ASD severity, parental romantic expectations (PRE), and parental provision of sexuality and relationship education.</td>
<td>Quantitative research design</td>
<td>12-18 years old (n = 190 parents)</td>
<td>SRS-2 and online sexuality survey (parent-report).</td>
<td>None</td>
</tr>
<tr>
<td>Lehan et al. 2016.</td>
<td>Parent Perceptions of Sexual Education Needs for Their Children With Autism, USA</td>
<td>To describe parent perceptions of sexual education needs of their children with ASD, and to determine parent-preferred mechanisms of delivery for tailored educational intervention strategies.</td>
<td>Qualitative research design</td>
<td>14-20 years old (n = 15 parents)</td>
<td>Parent perceptions of sexual education needs.</td>
<td>None</td>
</tr>
<tr>
<td>Vernon et al. 2016.</td>
<td>Social Tools And Rules for Teens (The START Program): Program Description and Preliminary Outcomes of an Experiential Socialization Intervention for Adolescents with Autism Spectrum Disorder, USA</td>
<td>To describe the START program, a multi-component socialization intervention that simultaneously targets motivational, conceptual, and skill deficits using a hybrid experiential/didactic treatment approach.</td>
<td>Clinical case series and a multiple baseline design</td>
<td>12-17 years old (n = 6)</td>
<td>Social competence and dynamic conversation.</td>
<td>Evidence of social competence improvements was noted, indicating that the START program may hold promise as a method for improving the social success of participating adolescents with ASD.</td>
</tr>
<tr>
<td>Visser et al. 2015.</td>
<td>Study protocol: a randomized controlled trial investigating the effects of a psychosexual training program for adolescents with autism spectrum disorder, The Netherlands</td>
<td>To investigate the effects of the Tackling Teenage Training (TTT) program on the psychosexual development of adolescents with ASD.</td>
<td>Study protocol of an RCT</td>
<td>12-18 years old (n = 200)</td>
<td>None</td>
<td>18 one-on-one sessions, 45-60 min. each, offering guidance and support with tackling difficulties with puberty and psychosexual functioning.</td>
</tr>
<tr>
<td>Visser et al. 2017.</td>
<td>A randomized controlled trial to examine the effects of the Tackling Teenage psychosexual training program for adolescents with autism spectrum disorder, The Netherlands</td>
<td>To investigate the effects of the TTT program on cognitive outcomes and behavioural outcomes.</td>
<td>RCT</td>
<td>12-18 years old (n = 189)</td>
<td>Psychosexual knowledge, insight in interpersonal boundaries, skills needed for romantic relationships and problematic sexual behaviour.</td>
<td>None</td>
</tr>
</tbody>
</table>
Table 5: Study protocol of excluded articles

<table>
<thead>
<tr>
<th>Author, year, title, country</th>
<th>Aim</th>
<th>Study type</th>
<th>Age group, n</th>
<th>Outcomes</th>
<th>Intervention</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Divan et al. 2015, Adapting an evidence-based intervention for autism spectrum disorder for scaling up in resource-constrained settings: the development of the PASS intervention in South Asia, South Asia</td>
<td>To report on the systematic adaptation of an evidence-based intervention, the Preschool Autism Communication Therapy (PACT) evaluated in a large trial in the United Kingdom for delivery in a low-resource setting through the process of task-shifting.</td>
<td>Qualitative research design</td>
<td>Children</td>
<td>Adaption of content and mode of delivery.</td>
<td>PASS is a communication intervention based on video-feedback, culturally adapted from the UK-based PACT intervention and enrolled in two South Asian locations.</td>
<td>The Parent-mediated intervention for Autism Spectrum Disorder in South Asia (PASS), shares the core theoretical foundations of the original PACT but is adjusted in several aspects to enhance its acceptability, feasibility, and scalability in low-resource settings.</td>
</tr>
<tr>
<td>Hong et al. 2017, The effects of video modelling in teaching functional living skills to persons with ASD: A meta-analysis of single-case studies, Japan</td>
<td>To determine the effectiveness of video modelling interventions for improving the functional living skills of individuals with ASD.</td>
<td>Meta-analysis of single-case research</td>
<td>Secondary school student/adolescents/adults (10 to &gt;15 years old) (n = 54)</td>
<td>Skills related to accessing the community category, employment skills, self-help skills and house chores</td>
<td>None</td>
<td>Video modelling interventions are overall moderately effective in teaching functional living skills to persons with ASD.</td>
</tr>
<tr>
<td>Kaboski et al. 2015, Brief Report: A Pilot Summer Robotics Camp to Reduce Social Anxiety and Improve Social/Vocational Skills in Adolescents with ASD, USA</td>
<td>To evaluate an intervention aiming to reduce social anxiety and improve social/vocational skills for adolescents with ASD.</td>
<td>Pilot study</td>
<td>12-17 years old (n = 8)</td>
<td>Social Anxiety Scale for Children-Revised (SASC), Social Anxiety Scale-Adolescents (SAS-A), Social Skills Improvement System (SSIS), and Robotics knowledge quiz.</td>
<td>One week robotics camp incl. robotic facts, programming an interactive robot, and learn ‘career’ skills.</td>
<td>The intervention sig. decrease social anxiety and increase robotics knowledge, but neither the intervention or comparison group showed a significant increase in social skills.</td>
</tr>
<tr>
<td>Laugeson et al. 2015, A Randomized Controlled Trial to Improve Social Skills in Young Adults with Autism Spectrum Disorder: The UCLA PEERS® Program, USA</td>
<td>To test the effectiveness of PEERS, a caregiver-assisted social skills program for high-functioning young adults without intellectual disabilities with ASD.</td>
<td>RCT</td>
<td>18-24 years old (n = 22)</td>
<td>Social skills, frequency of social engagement, social skills knowledge and social responsiveness.</td>
<td>16 weekly 90-min social skills training sessions delivered in the community at The Help Group.</td>
<td>The intervention sig. improved overall social skills, frequency of social engagement, and social skills knowledge, and significantly reduced ASD symptoms related to social responsiveness.</td>
</tr>
<tr>
<td>Lyons et al. 2016, Assessing the Social Skills and Problem Behaviors of Adolescents With Severe Disabilities Enrolled in General Education Classes, Japan</td>
<td>To examine the social skills and problem behaviours of adolescents with severe disabilities</td>
<td>Quantitative research design</td>
<td>14-20 years old (n = 137)</td>
<td>Social skills and problem behaviours</td>
<td>None</td>
<td>Social skills were considerably below average, and problem behaviours were above average (parent and teacher report).</td>
</tr>
<tr>
<td>Okano et al. 2016, Simultaneous Training for Children with Autism Spectrum Disorder and Their Parents with a Focus on Social Skills Enhancement, Japan</td>
<td>To evaluate the effectiveness of simultaneous training for children with ASD and their parents, by evaluating behavioural changes in children with ASD and changes in family functioning.</td>
<td>Intervention study</td>
<td>Elementary school age old (n = 17)</td>
<td>Social skills scale for education (SS-scale), the child behaviour checklist, the Feetham Family Functioning Survey (FFFS), and the confidence degree questionnaire for families (CDQ)</td>
<td>10 consecutive 90 min. sessions held every 1 to 2 weeks and completed within six months incl. recognition and understanding of emotion; theory of mind; and executive functions/real life-type problem solving through teaching, modelling, role-playing, rehearsal, feedback, and homework related to the target skills.</td>
<td>Improvements in communication skills on the children's SS-scale, sig. improvements the mothers’ FFFS scores for illness and worries and in the median CDQ scores for one of 18 items after STSSE.</td>
</tr>
<tr>
<td>Waugh &amp; Peskin 2015, Improving the Social Skills of Children with HFASD: An Intervention Study, USA</td>
<td>To examines the efficacy of a social skills and Theory of Mind (S.S.ToM) intervention for children with high-functioning ASD.</td>
<td>Intervention study</td>
<td>6-13 years old (n = 49)</td>
<td>ToM and social responsiveness</td>
<td>Children’s Friendship Training (CFT): 12-week parent-assisted social skills intervention.</td>
<td>S.S.ToM participants demonstrated significantly greater gains on measures of ToM and social responsiveness following PEERS.</td>
</tr>
</tbody>
</table>
2.0 Background: Autism spectrum disorder

2.1 Definition of Autism Spectrum Disorder

*Autism spectrum disorder* (ASD) is a developmental neuropsychiatric syndrome with persistent impaired social communication and social interaction skills across multiple contexts. For instance, this is manifested by deficits in nonverbal communicative behaviours and social-emotional reciprocity, as well as deficits in developing, maintaining, and understanding relationships. The severity is based on social communication difficulties and repetitive and stereotyped patterns of behaviour, interests and activities, with the recognition that severity may vary by context and time (APA 2013).

2.2 History of autism

Autism was first described and named by Leo Kanner in 1943 and Hans Asperger in 1944. The essential symptoms of autism in Kanner’s early descriptions were the child’s autistic isolation and obsessive desire for preservation of repetitiveness. Even though the diagnosis of autism is still defined on the basis of behaviour, it has changed in different ways as more has been learnt about the disorder due to new research (Happé, 1994, p.15).

In 1988, L. Wing introduced the concept of a *spectrum* of disorders in autism to capture the idea of a wide range of manifestations of the same disorder (Happé, 1994). It is widely believed that all types of autism are prenatally derived and affects the developing brain, but their impact on mental development can differ, which cause a huge variation of related behaviour (Frith & Sofie Hauch Winiarczyk, 2010, p.17). Common characteristics can be explained by a set of three fundamental impairments, known as *Wing’s triad*, including impairments in socialization, communication and imagination (Happé 1994).

Wing’s triad has become the basis of diagnosis of autism in one of the two major diagnostic instruments currently used (Happé 1994); the International classification of diseases (ICD) 10th revision (ICD-10). The ICD-10 was first published by WHO in 1990 and is currently under revision (WHO 2017). The ICD was not used in this study, thus, it will not be mentioned any further. Instead, the current study applies the other major diagnostic instrument; DSM-5, in which Wing’s triad has been narrowed down to a dyad, consisting of the two aspects:

a) Deficits in social communication and social interaction across multiple contexts
b) Restricted, repetitive patterns of behaviour, interests, or activities. (APA 2013, p.50). 

Thereby, the triad and dyad have the same content but different structures.

DSM is a guide to the diagnosis of mental disorder used by health care professionals in the United States and world-wide (APA 2017; Kim et al. 2011) and was first published by APA in 1952. It has periodically been revised, most recently in 2013 (DSM-5) where the diagnosis of autism, Pervasive Developmental Disorder (PDD), PDD-Not Otherwise Specified (PDD-NOS) and Asperger’s Syndrome has shifted from a multi-categorical model to a strict single diagnostic category named autism spectrum disorder (ASD) (Azeem et al. 2016; Joseph et al. 2016). Thereby, the term ASD in DSM-5 includes both people with and without normal intelligence and with and without normal language (Smith et al. 2015). Throughout this study, the DSM-5 diagnostic instrument will be used in accordance with the recent published RCT by Visser et al. (2017) testing the effect of TTT in a large sample in the Netherlands.

2.3 Prognostic and risk factors

Prognostic factors for individuals with ASD include associated intellectual disability, additional mental health problems and language impairment by age 5 years. According to Christensen et al. (2016) the prevalence of ASD without intellectual disability (Middle (M) = 8.7 per 1,000) exceeds the prevalence of ASD with intellectual disability (M = 4.0 per 1,000) among 8 years old children in eleven counties in the United States (Christensen et al. 2016).

Probable risk factors for ASD can be divided into environmental and genetic factors. Environmental factors that may contribute to risk of ASD include advanced parental age, low birth weight or fetal exposure to valproate, which is a first-line anti-epileptic drug (APA 2013). Moreover, Grant and Soles (2009) support the role of maternal vitamin-D deficiency as a risk factor for the development of infantile autism, but further investigation of this hypothesis is necessary (Azeem et al. 2016; Grant & Soles 2009). Knowledge on genetic and physiological factors have been lacking until the last decade. Consistent neuropathology on ASD was missing and only insufficient knowledge of a few causal genetic factors was available. Then, in the last decade genetic findings in ASD have increased largely, as several dozen ASD susceptibility genes have been identified (Geschwind, 2011). According to Daniel H. Geschwind (2011) between 10-20
percent of ASD cases may likely be associated with a known genetic mutation. However, these cases do not appear to be fully manifested (APA 2013; Geschwind 2011).

2.4 Symptoms
The symptoms of ASD can be present from 12-24 months of age depending on the severity. Early symptoms often include delayed language development, frequently supplemented with lack of social interest, abnormal play patterns and unusual communication patterns. These early symptoms may not be manifested completely until later in life, when social demands exceed the individual’s limited abilities. During adolescence, a small proportion of individuals deteriorate behaviourally, whereas most improve (APA 2013).

2.5 Diagnostic criteria
According to the fifth edition of DSM the main diagnostic criteria for ASD are persistent deficits in social communication and social interactions. This may be manifested by i.e. deficits in social-emotional reciprocity and in developing, maintaining, and understanding relationships. Moreover, diagnostic criteria include restricted, repetitive patterns of behaviour, interests, or activities, which may be demonstrated by repetitive motor movements, ritualized patterns of verbal and non-verbal behaviour, and hyper- or hyposensitivity to sensory input (APA 2013; APA 2017).

2.6 Functional consequences
In accordance to DSM-5, symptoms of ASD cause clinically significant impairment in social communication and interaction (APA 2013), which may hinder learning, especially learning through peers. For example, extreme difficulties in organising and planning has a negative impact on academic achievements, even for those students with above-average IQ. Moreover, ASD may cause inflexibility and difficulty with change throughout adulthood (APA, 2013, p.57).

2.7 Sex differences
Globally, ASD is diagnosed four to four-and-a-half times more frequent in males than in females (APA 2013; Christensen et al. 2016). In 2012, estimates from the United States show that the prevalence among 8-year-old children was 23.5 per 1,000 boys (about 2.35%) and 5.3 per 1,000 girls (about 0.53%) (Christensen et al. 2016). Though, in South Korea the highest ASD prevalence
rate estimates has been reported in which approximately 37.4 per 1000 (about 3.74%) were males and 14.7 per 1000 (about 1.47%) were females (Joseph et al., 2016, p.20; Kim et al., 2011).

Werling and Geschwind (2013) emphasize that sex differences in phenotypic presentation, may contribute to the biological basis of this male-biased prevalence in ASD (Werling & Geschwind 2013). The major drivers of sex-differential liability are explained in genetic studies as ‘female-protective factors’ from heritable and de-novo ASD risk mutation. Thereby, females are less vulnerable to develop ASD compared to males due to several sex-differential genetic and hormonal factors (Werling & Geschwind 2013). Empirical support for the hypothesis of a female-protective effect against autistic behaviour is demonstrated in findings from Robinson et al. (2013). Based on two nationally-representative samples from longitudinal twin studies in United Kingdom and Sweden, these findings suggest that the female sex protects from autistic impairments. Moreover, it shows that girls may need higher familial etiologic load to manifest the phenotype (Robinson et al. 2013). In addition, the skewed distribution in ASD may likely be attributed to accompanying intellectual impairments and language delays in females. Thereby, a lack of these symptoms may leave the syndrome unrecognised in some females with ASD (APA, 2013, p.57).

2.8 Comorbidities
Comorbid medical and psychiatric conditions are common and frequently multiple in children with ASD and adolescents and young adults with ASD respectively. In children (M = 11.5 years) with ASD, 70 percent may have at least one, and 41 percent may have two or more comorbid mental disorder (Simonoff et al. 2008). In adolescents and young adults (M = 19.5) with ASD, 42 percent may have at least one comorbid mental disorder (Moseley et al. 2011). A variety of these comorbid diagnoses include epilepsy, social anxiety disorder, Attention-deficit/hyperactivity disorder (ADHD), and oppositional defiant disorder, major depressive disorder, and disruptive behaviour disorder not otherwise specified (Moseley et al. 2011; Simonoff et al. 2008).

3.0 Theoretical framework
3.1 Wing’s triad of impairment
In the section ‘history of autism’, it was mentioned that autism is characterised by a triad of impairments, including impairments in socialisation, communication and imagination. Though,
these impairments all consist of a wide range of different behaviours relying on multiple cognitive mechanisms occurring in diverse points in normal development. When reviewing the cognitive theories of autism, the challenge is to explain specific pattern of deficits in all of the three areas of autism (Happé, 1994, p.35). This is why the specific nature of Wing’s triad of impairments will be described further, before looking into one of the current theories of autism at the cognitive level: Theory of Mind (ToM).

3.1.1 Socialisation

In TD children the ability to interact socially is thought to be innate and can be observed as early as from birth (Wing et al. 2011). Even though they are not fully impaired in social functioning, autistic children often show a specific pattern of impairment in social understanding characterised by a pronounced lack of interest in other people. Early non-verbal signs indicating such impairment include an inability to share direct attention (i.e. not making eye contact or pointing), having difficulties with imitation and copying movements, and having impaired recognition of affect and emotions (Happé, 1994, pp.35-36; Lorna Wing et al., 2011), which is acquired automatically in TD children (Frith 1991; Frith & Sofie Hauch Winiarczyk 2010). As some children with ASD grow older they develop an interest in other people, but they still struggle with their understanding of social rules (Herbert 2003). Thus, one distinct sign of lacking reciprocal social interaction is lack of social contact to peers (Frith & Sofie Hauch Winiarczyk, 2010, p.21).

One of the most powerful predictors of mental health and well-being in adulthood is peer acceptance throughout elementary school. More studies indicate that children with high-functioning ASD report significantly higher levels of victimization, loneliness, anxiety and depression compared to their TD peers, due to social deficits and lack of friendships (Jennett et al. 2013; Mazurek & Kanne 2010; Mayes et al. 2011; Bauminger & Kasari 2000; Waugh & Peskin 2015). Therefore, the need to teach skills that might enhance peer acceptance and potentially result in friendship formation, is highly important. This is one of the objectives of the TTT intervention program, in which session 8 particularly focus on friendships and more sessions teach skills that might enhance peer acceptance (e.g. session 2 on appearances, session 3 on first impressions and session 7 on masturbation).
3.1.2 Communication

The impairment in social communication specific related to autism refers to reduced verbal and non-verbal communication skills (Wing et al. 2011). Several communication problems that seem to be specific related to autism include delay or lack of development of speech, stereotyped and repetitive language, failure to initiate or sustain conversation normally, lack of gesture and facial expression and difficulty in understanding non-verbal signs of others (Durkin et al., 2015; Happé, 1994, pp.36-37; L Wing, 1981). In those who acquire language, speech may seem well developed as many individuals have a normal vocabulary (Howlin 2004). Nevertheless, there may be difficulties with comprehension of language in social contexts, exemplified by the autistic child’s literal interpretation of language (Happé, 1994, pp.36-37).

3.1.3 Imagination

The impairment in social imagination can be explained as a decreased ability to understand and predict the behaviour of others, make sense of abstract ideas and imagine situations outside one’s typical daily routine (Wing et al. 2011). In autistic children, lack of imagination may be shown by extreme repetitive activities, absence of pretended play and by being completely spellbound by a narrow interest (Frith & Sofie Hauch Winiarczyk, 2010, p.22; Happé, 1994, p.37). The repetitive behaviour can also be viewed as extreme stubbornness shown as strong reluctance against changes and new things. These extreme behavioural patterns are typically less visible in adults due to education and experiences (Frith & Sofie Hauch Winiarczyk, 2010, p.22). Though, the obsessive functional play of the child, may become obsessive interests of the adult, due to their narrowed and circumscribed nature exemplified by railway timetables, bus routes and dates of birth (Happé, 1994, p.37).

Due to impairments in social imagination and social communication, it has been proven that adolescents with ASD find it difficult to recognise their own and other people’s boundaries and to express their own personal boundaries to others. This often make the adolescents not seeing the consequences of other people’s and their own behaviour, e.g. when experimenting with relationships and sexuality. Therefore, adolescents with ASD are vulnerable to crossing other people’s boundaries unintentionally or to become victims of sexual offence (Attwood 2000; Crone et al. 2008; Henault 2006). In the TTT program (session 15 and 16 on personal boundaries and privacy) the adolescents learn e.g. how to recognise their own and other’s personal boundaries, how
boundaries can be clearly informed to other people, and how to respect other people’s boundaries. In addition, the right to privacy is discussed to make the adolescent become aware of this right and learn how to protect it.

3.2 Theory of mind deficit

Theory of Mind Deficit (ToM; Baron-Cohen et al. 1985) might be the most dominant theory in the field of autism and creates the basis for the way the TTT intervention is developed and organised, which is the reason why it will be described further in this chapter.

ToM is a psychological cognitive theory, which has proven successful at predicting and explaining both the universal and the specific features of autism. The theory suggests that the triad of behavioural impairments in autism may be caused by a deficiency of the fundamental human ability to mentalise. This means that autistic people may lack the ability to attribute independent mental states of self and others, in order to explain behaviour, which makes them disadvantaged in certain social, communicative and imaginative skills (Happé, 1994, pp.34-51). The lack of intuitive mentalisation is also known as mind-blindness, which indicate that social impairment may follow from a lack of appreciation of people as agents with independent minds. In addition, fundamental communication impairments may be due to an inability to imagine intentions (Happé, 1994, p.49).

This theory is criticised for not being universal to all people with ASD, and that people without ASD, but with another syndrome, might also not be able to solve tasks related to mentalisation. Moreover, the theory is criticised for ignoring the emotional aspects of social communication, especially those related to instinctive and intimate sharing of emotions (Frith & Sofie Hauch Winiarczyk, 2010, pp.71-76). However, ToM is the most commonly applied and most researched theory on the difficulties caused by ASD (Merrill 2015).

4.0 Methods

4.1 Study design

The study was an uncontrolled pre-and post-training design incorporated in a care-as-usual setting performed in three study sites participating in the pilot implementation of the TTT program.
4.1.1 Setting

The study population was 12-17 years old adolescents (at baseline assessment) with ASD living in two regions of Denmark; Region Zealand and the Capital Region of Denmark. The aim of this quantitative study is to provide a scope of understanding of the three variables; psychosexual knowledge, level of self-concept and sexual behaviour. Various study sites have been identified, taking into consideration the research objectives, the characteristics of the study sites, the willingness of the professional staff members (i.e. teachers, psychologists and social educators) and leaders to participate in and facilitate the study, and conduct the research. For example, the effect of TTT materials on level on psychosexual knowledge, self-concept and sexual behaviour in adolescents with ASD are best tested in educational settings where adolescents with ASD gather and where professional trainers are available.

The following three study sites were chosen; a) Basen School placed in Copenhagen providing individualised and flexible educational and treatment programs to children and young people with diagnoses, b) Harløse School located in Hillerød offering special education for children and young people with ASD, and c) Center for Autism (CFA), which is a large mental health care institution for neurodevelopmental disorders receiving clients from the entire country. All three sites are located in the Capital Region of Denmark, but adolescents living in Region Zealand were also included in the study population.

Geographically, the study sites are situated within the Capital Region of Denmark and placed differently across six socioeconomic parameters at municipality level (Baltzarsen et al. 2015). Data collected by Danish Statistics and Experian from 2013 and 2014, indicate that the Hillerød Municipality (location of Harløse School) has a high socioeconomic position ranking number 16 out of 98 municipalities in Denmark, and Herlev Municipality (location of CFA) is ranked number 38, which is also higher than average socioeconomic position of municipalities in Denmark. Contrary, the Municipality of Copenhagen (location of Basen School) is ranked number 57 out of 98 municipalities in Denmark, indicating a socioeconomic position slightly lower than average (Baltzarsen et al. 2015).
4.1.2 Sampling method

Since it is, in general, impossible to cover every person in the selected population, the study relies on a sampling strategy. Sampling strategies for quantitative methods used in implementation research are generally well-established and based on probability theory. In probability sampling, generalizability of findings from the sample to the larger population is ensured by minimising the potential for selection bias. Moreover, potential influence of known and unknown confounders are controlled for (Palinkas et al. 2015). There exist numerous probability sampling designs including simple random sampling, systematic sampling, stratified sampling, cluster sampling and multi-stage sampling. In this study, cluster sampling was chosen as it was assessed to be difficult to take a simple random sample of individuals from the study population. The cause of this sampling method was mainly logistical difficulties (i.e. screening participant spread over a large area may be too time-consuming) and lack of resources (i.e. man-hours) in order to provide the TTT programme.

In contrast, purposeful sampling is a technique widely used in qualitative methods for the selection of information-rich cases, in order to obtain comprehensive in-depth understanding of an issue by continuing to sample until no new applicable information is acquired (Miles & Huberman 1994; Palinkas et al. 2015).

4.1.2.1 Bias

Bias in sampling procedures and improper sampling are systematic errors that leads to a falsification in the results or the sample not being representative of the study population. One major source of bias is non-response (e.g. due to fear of consequences of disclosing sensitive matters), which is typically encountered in studies where participants are interviewed or asked to fill in a questionnaire. As a consequence, they may refuse or forget to fill in the questionnaire, which is problematic as they possibly display characteristics that differ systematically from the characteristics of the respondents (Hardon, Hodgkin, & Fresle, 2004, pp.63-64). In this study, the non-response rate from T1 to T2 was 10 percent (n = 3) due to refusal to corporate. In all cases this was based on coloured pictures of male and female genitals, which the non-respondents found too intense. To combat non-respondent bias, adjustments to the test material were made to ensure better corporation, i.e. black-white coloured copies of pictures in the PKT and allowance of respondents to fold the questionnaire and write ID number instead of name.
Another source of bias is to study *volunteers only*, which produces selectivity and may result in motivated participants who differ from the study population in studied factors (WHO, 2004, p.418). To combat this factor, only the participants recruited from one study site (CFA, n = 7) were participating on volunteering basis with no individual invitation.

The final bias mentioned here, which is relevant to this study is *tarmac bias*, as the study sites were partly selected because they were easily accessible in order to good working relationship between Danish Autism Centre and the two special schools. Other special schools were requested to participate, but refused due to lack of resources and surplus energy for participating in the TTT program. Though, previously in section 4.1.1 (p. 34) it was described that more factors were deciding which study sites were selected.

### 4.1.3 Recruitment of participants

The recruitment of participants took place between August 2015 and September 2016. At the two schools for special education (Basen School and Harløse School) the participants (n = 20) were recruited through referrals from five professionals working at the study sites. All professional had thorough knowledge of the program and the adolescents. Referrals were made based on the needs of the adolescent, either because the professional predicted future issues regarding the psychosexual functioning of the adolescent (primary prevention) or because the teenager’s preoccupation by sexual issues had already occurred (secondary prevention). Afterwards, the selected adolescents and their parents got informed about the programme and an information letter was provided to each adolescent. If both parents and adolescent were interested in joining to the programme they were enrolled in the TTT program and screened (more details in section 4.1.4, p.37).

The recruitment procedure at the CFA differs from the two other study sites. Though open application, motivated parents joining the newsletter or website of CFA were recommended to apply for TTT training, if they and their adolescent with ASD was interested to attend the TTT program. In the application, a description of age, diagnosis and intelligence level of the adolescent was required. If the applicants met the inclusion criteria, more detailed information about the study was sent through email with an attached information letter to the adolescent (similar to the two other study sites). The parents were advised to consider the possibility for transportation of the child to the study site at CFA in Herlev once a week in 18 weeks, and additionally once prior to and after
end training. Moreover, it was mentioned that no financial compensation for transportation costs was offered. If parents confirmed their and the adolescent’s interest, they were enrolled in the program and screened (more details in section; “6.1.4 Screening and selection of participants”).

4.1.4 Screening and selection of participants
In all three sites, heterogenic participant profiles were preferred, related to core symptoms, age, cognitive function, verbal language level and adaptive behaviour. More specifically, adolescents were screened for the following in- and exclusion criteria.

Firstly, an inclusion criteria was a diagnosis within the autism spectrum defined by comprehensive golden standard of psychological diagnosis measures; Autism Diagnostic Observation Schedule 2 (ADOS-2, Lord et al., 2012) and Autism Diagnostic Interview-Revised (ADI-R, Rutter et al., 2005). Even though most of the selected adolescents attended schools for pupils diagnosed with ASD (i.e. Harløse School in Hillerød, n = 11) for which enrolment require valid diagnosis of ASD, diagnosis was reconfirmed by conducting ADOS-2, ADI-R and SRS. The tests were conducted by professional psychologists. In few cases (n = 2) no ADOS-2 and ADI-R diagnostic test was obtained, but the parents were requested to report details on how and by whom diagnosis was established, indicating that a ASD diagnose had been made by a licensed child psychiatrists, psychologists, paediatricians, or multi-disciplinary teams. In combination with the results of SRS, this information was acceptable for inclusion in the TTT program.

Secondly, an exclusion criterion was adolescents with comorbid intellectual disability, defined by WHO as:

“A significant reduced ability to understand new or complex information and to learn and apply new skills (impaired intelligence), with a reduced ability to cope independently (impaired social functioning) which started before adulthood, and has a lasting effect on development.” (WHO Regional Office for Europe 2010).

In this study adolescents with mild to severe gradation of disorder of intellectual development (ICD-10 code F70-F79), determined as an intellectual ability quotient (IQ) score less than 70 points (Bertelsen 2003), was excluded from the study (n = 1, RIAS T-score 63, CI 60;67). An inclusion criterion included adolescent with an IQ score within clinical normal to high range (full IQ ≥ 85 point; Bertelsen 2003), measured by standardized intelligence tests; Reynolds Intellectual
Assessment Scales (RIAS; Reynolds & Kamphaus 2003) and the Wechsler Intelligence Scale for Children version 5 (WISC-V; Wechsler 2014). The IQ score was acquired from the medical file of the adolescent and used if the assessment was not older than two years old (in one case four years was accepted), and if a valid and reliable instrument was used (i.e. RIAS: n = 1 or WISC-V: n = 1). In most cases (n = 27), no or no resent IQ measurement was available, and IQ was assessed using the RIAS.

Thirdly, adolescents that portrayed offensive sexual behaviour (i.e. law-violating behaviour) were not eligible for this study. As the professionals that referred subjects to this study were familiar with the design of the study (explained in master-class sessions), they were competent to exclude adolescents with too severe, offensive law-violating levels of sexual problems or inappropriate sexual behaviours in case these would be interested in participating in the TTT program. To the knowledge of the author, no such case occurred and the final selected participants were 29 none offensive cognitively able boys (n = 19) and girls (n = 10) aged 12-17 years old at baseline, and diagnosed with ASD following the DSM-5 criteria (APA 2013).

For more details on screening and diagnostic instruments see section 4.6 (p.45) and section 4.7 (p.47).

4.1.4.1 Sample size

The standard for determining the required number of participants rely on an established formula for avoiding systematic Type 1 and Type 2 errors, which is either to detect an effect that is not present (false positive), or not to detect an effect that is present (false negative) (Palinkas et al. 2015). As a general rule the desirable sample size is determined by the expected variation in the data. In order to attain the same level of accuracy, the more varied a data set is it require a larger sample size (Hardon et al., 2004, pp.64-65). Based on results from a resent larger randomised controlled trail (n = 189) examining the effect of TTT for adolescents with ASD in the Netherlands (Visser et al., 2017), some variation was reported in demographics of the participants at baseline (full intelligence quotient (range 86-140), SRS total score (range 52-153), CBCL externalising problems (range 0-55) and CBCL internalising problems (range 4-45)), cognitive outcome measure (PKS (SD = 7.71)) and behavioural outcome measure (SRS total score (SD = 24.92)). Thereby, variation is expected, which is why a large sample size is recommended. Though, the sample size must be feasible, which
is determined by the availability of resources (i.e. funding). This was a limiting factor in the current pilot study, since it is extremely costly to enrol the TTT program due to a large number of man-hours.

4.1.5 Multiple reporters

Using multiple reporters is the recommended best practice approach, as both self-reported and parent-reported sources provide unique and meaningful information (Achenbach et al. 1987; Jensen et al. 1999). Specifically, Jensen et al. (1999) determined that:

“For most conditions among 9–17-year-old children, both parent and child informants are necessary to obtain adequate diagnostic information, even though using only one informant may be appealing as more convenient or less costly.” (Jensen et al., 1999, p.1577).

In addition, Mazefsky, Kao & Oswald (2011) conclude, that self-report measures administered to individuals with ASD may provide further valuable information for clinical decision-making, and may be essential to interpret in combination with clinical judgements. Though, they underline the importance of conducting supplementary assessments if other signs of psychiatric conditions are present based on observation-, parent- or teacher reports, even in the event of negative outcomes on self-report measures. Thus, in this study both parent or caregiver and professional-reported screening and diagnostic instruments were used (Mazefsky et al. 2011).

4.2 Intervention procedure

When allocated to participate in the TTT program, the parents and adolescent was invited to a personal introduction meeting with the trainer, at which the purpose of the research study, expected time-investment and the content of the program were discussed. After this joint meeting parents and adolescents were separated and baseline measures was assessed. In total, questionnaires were distributed at three time points; at baseline (T1: one week prior to TTT), posttreatment (T2: after 6 months), and follow-up (T3: after 12 months). In order to reflect the perception of the adolescents with ASD and their parents, both self- and parent-reported questionnaires was used (previously described in section 4.1.5, p.39).

The training program consists of 18 weekly one-hour (30-60 min.) sessions provided individually (one-on-one) by 10 female trainers who had a bachelor’s or master’s degree in psychology, health science or social services. The majority (90 %) had minimum three years of working experience
with people with ASD. All trainers joined a 2-day train-the-trainer course (n = 9) provided by the
developers of TTT from Yulius Academy in the Netherlands, and participated in interdisciplinary
meetings every third months held by CFA, to discuss questions and case reports with other
professionals. Alternatively, one trainer acquired a 3 hours individual training-cause and
supervision every second week, provided by a professional Social Educator with experience in
TTT. Each adolescent was assigned to one trainer for the duration of the entire TTT program.

The participants started the TTT program within one month after collection of T1 data except from
three cases where T1 for adolescents was collected 1.22 and 2.14 months before, and 2.33 months
after the first training session. In the whole sample T1 and T2 measurements were on average 6
months apart (M = 6.34, SD = 1.67; range 3.22-9.47 months). Approximately one week after last
training session (T2), a personal evaluative session was held with the parents and adolescents. In
addition to T2 adolescent and parent directed questionnaires, the parents and adolescents also filled
out an evaluation form in which they indicated if knowledge and skills acquired in the training
program was applied in everyday life.

4.3 Quality assurance
Fidelity was investigated by a) assessing protocol adherence by the trainer, and b) measuring
received training during the study. Protocol adherence was assessed by number of skipped and
adjusted exercises monitored by a standardized short evaluation form completed by the trainer after
each session. Moreover, the trainer rated motivation, resistance and difficulty of the session for the
adolescent. Besides, in one questionnaire (TTI) assessed at T1, T2 and T3 all adolescents and their
parents were asked if and by whom they have received sexual education (i.e. from parents, teachers,
or in a special intervention) in the last six months. Thereby, it was possible to control for this bias in
the main analyses in case it turned out to be influential on the outcomes.

4.4 Intervention
The TTT intervention program comprises a program manual for the trainer and a workbook for the
adolescent (Dekker et al. 2015). The trainers’ manual contains a detailed protocol that guides the
trainer through each session with an introduction to the topic and a description of the related
exercises, whereas the workbook contains texts, exercises and illustrations. The TTT workbook is
available in Dutch, English, Greek and Spanish and was preliminary translated to Danish prior to
this study. The TTT program can be used for two purposes: a) for primary prevention purposes, to promote healthy psychosexual development in adolescents with ASD, or b) for secondary prevention purposes, when problems in sexual behaviour is present in adolescents with ASD. In this study, the focus of the intervention is primarily to promote healthy psychosexual development, as none of the participants had severe inappropriate sexual behaviour according to the inclusion criteria.

The TTT program covers the following lesson themes: introduction to the training program and puberty (session 1), appearances (session 2), first impressions (session 3), naming different body parts (session 4), physical and emotional changes during puberty (session 5 and 6), masturbation (session 7), friendship (session 8), falling in love and dating (session 9, 11 and 18), sexual orientation (session 10), safe sex (e.g. sexual contact, intercourse and contraception) (session 12 and 13), pregnancy and birth (session 14), personal boundaries and privacy (session 15 and 16) and safe internet use (session 17).

At each session, a consistent structure is used. First, the materials of the specific session are added to the workbook of the adolescent, and thereby creates an extensive reference guide for the adolescent over the course of the training program. Then, the front-page picture illustrating the topic of the session is discussed. The illustration opens up for reflections on what the session will be about, and which story the picture is telling. Afterwards, the student is asked to fill out a quiz, which indicates the pre-knowledge of the adolescent in relation to the specific topic. This task is useful for the trainer in order to tailor the training to the adolescent based on the answers to the quiz. Hereafter, a text explaining related sub-topics is read aloud, alternated with several exercises. In total, the TTT program consists of 112 exercises including knowledge and insight questions, questions for discussion e.g. based on illustrations and role plays with the trainer. Some of the exercises involve a training kit, which includes materials for educational purposes, such as a model penis, contraceptives and lubricant. In this way, the theoretical knowledge is supported with practical demonstrations and explicit skills training by use of the materials. In the end of each session, a take-home assignment is explained by the trainer. The take-home assignment request the adolescent to practice or discuss the topic of that session outside of the context of the training. Examples of take-home assignments is to reflect on episodes where the adolescent itself has crossed others boundaries or has experienced his own boundaries being crossed, to carry out a short
interview with a primary caregiver or to arrange a get together with a friend. The take-home assignment is discussed with the trainer in the beginning of the following session. Besides, the trainer weekly informs parents on the progress of the training, via structured standard reports sent by e-mail. These reports consist of background information on the topic of the session, and a description of the take-home assignment. If any, the trainer adds personal details on notable strengths and difficulties of the adolescent during the specific session. The feedback to the parents are only provided with the permission of the adolescents (n = 15). The involvement of parents in take-home assignments and through the weekly reports, is intended to stimulate communication about psychosexual subjects between the adolescents and their parents, and to enhance transferability of learned knowledge, insight and skills to other contexts outside the setting of the training.

4.5 Ethical considerations

4.5.1. Ethical approval

The current health science research project was not approved by the Regional Scientific Ethical Committee (VEK) nor The National Committee on Health Research Ethics (DNVK) in accordance to their guidelines for Ethical Approval of Research (NVK 2017). More specifically, the study does not meet the requirements for appliance of ethical approval due to the type of intervention (i.e. no medical treatment, only education) and test instruments (i.e. no behavioural or physical tests).

4.5.2 Ethical principles

This study follows the Ethical Principles for Nordic Psychologists’ Rulebook 2012-2014 (The Nordic Committee of Psychological Associations (SAK) 2012) in accordance with the Meta-Code of Ethics developed by The European Federation of Psychologist’ Association. Since psychologists often profoundly influence other people in their work, pressure is put on psychologists’ ethical consciousness, which is why these principles was developed. The most recent edition of the Principles for Nordic Psychologists aim to e.g. guide and support ethical reflections on ethical dilemmas; protect clients against inexpedient and/or harmful intervention and sustain the confidence in the professional work of psychologists. The Ethical Principles for Nordic Psychologists are divided into four main principles concerning a) respect for the client’s rights and values; b) competence; c) responsibility; and d) integrity (The Nordic Committee of Psychological Associations (SAK) 2012).
4.5.2.1 Respect for the client’s rights and values

In accordance to the Ethical Principles for Nordic Psychologists all trainers showed respect for the human rights, values and integrity of the adolescents and their parents (referred to as ‘participants’), and endeavoured not to use the professional knowledge in a way which violate, exploits or suppress the participants. In addition, the trainers were attentive and respectful towards knowledge, experience and expertise of the participants, colleagues and other professionals. Moreover, the trainers were attentive towards individual and cultural inequalities due to functional level, age, gender, religion, ethnic background, religion and sexual orientation of the participants as well as prerequisites related to their own culture, gender and social status.

Throughout the programme the participants were informed on schedules activities. Consent forms were distributed prior to the training programme and written informed consent was obtained from all participants. In the consent forms the voluntary principle was explained, in order to ensure the right to enter and leave the programme. In addition, professional secrecy was signed by all involved professionals, in order to protect the participants’ right to confidentiality. Exceptions of the professional secrecy were made in case of oblivious danger for the participants themselves or others. For example, when one participant described her self-destructive behaviour, the issue was discussed among colleagues and parents got informed.

4.5.2.2 Competence

The trainers strived towards consciousness about professional and human strengths and weaknesses, in order to adapt tasks, benefits and methods in accordance to qualifications by virtue of education, training and experience. Moreover, they were enrolled in supervision programmes or meetings with fellow trainers, in order to receive professional support in difficult situations. Furthermore, the trainers were all aware of the design of the TTT programme including the flexibility and limits of the procedure.

4.5.2.3 Responsibility

All trainers were attentive towards the professional and scientific responsibility of the participant and the workplace, including the quality and consequences of own work. This included not to put pressure on the participants in order to reveal, deny or change personal experiences, opinions or view of life.
4.5.2.4 Integrity
In accordance to the Ethical Principles for Nordic Psychologists all professionals in the programme aimed to provide professional integrity including honest, impartial and respectful appearance towards all concerned. Thus, they clarified their own qualifications, educational background and position. Moreover, they were all conscious of their own needs, opinions and assessments and their role in the relation to the participants. Hence, they avoided non-professional relations to the participants, which may hinder a professional distance. This included avoidance of any private and sexual relationships with the participants.

4.6 Screening instruments
The used screening instruments in the current study are both parent and professional-reported. The general aim of the parent-reported instruments (i.e. the Social Responsiveness Scale, SRS) is to make fast decisions if a person has a specific behaviour or developmental profile, which require additional diagnosing. In general, these instruments are often cost-effective questionnaires that are easy to apply (Joseph et al., 2016, p.40). Contrary, screening methods applied by professionals (i.e. Reynolds Intellectual Assessment Scales, RIAS) are developed for screening of vulnerable populations, such as delayed or abnormal developed children, and often consists of questionnaires, observations and short interviews. These methods are typically more administration consuming and requires a certain level of education (Joseph et al., 2016, p.40).

4.6.1 Social Responsiveness Scale (SRS)
The SRS (Constantino & Gruber 2002) is among the most frequently applied parent/caregiver reported ASD screening instruments (Joseph et al., 2015). The SRS was reported at T1 (n = 13), T2 (n = 9) and T3 (n = 13) by parents, who are familiar with the adolescent’s current behaviour and developmental history, whereas the scoring and interpretation was made by a master’s thesis student (MSc in Global Health, Louise S. H. Thomsen) supervised by experienced psychologists from CFA.

The SRS is a standardised 65-item questionnaire assessing the severity of characteristic autistic behaviour including various dimensions of the five subscale areas; social awareness (i.e. ability to pick up on social cues), social cognition (i.e. ability to interpret social cues), social communication (e.g. expressive social communication), social motivation (e.g. general motivation to engage in
social-interpersonal behaviour) and autistic mannerisms (i.e. stereotypical behaviours or highly restricted interests characteristics of autism). The information collected from this scale is beneficial in assessing a 4-18-year-old children and adolescents’ strengths and weaknesses in the five mentioned areas (Constantino & Gruber 2002). Thus, in this study SRS was primarily administered to assess potential changes in the social functioning of the studied adolescents but also to support differentiation between ASD populations and non-ASD populations in order to qualify adolescents for the TTT program.

Each item is rated at a Likert scale from 0 (“never true”) to 3 (“almost always true”) giving a total score ranging from 0-195, with higher scores reflecting a greater degree of social impairment. A total T-score at 76 or more indicate severe, strong association to a clinical diagnosis of ASD, whereas a total t-score at 60-75 suggests a mild to moderate association and a total T-score at 59 or below implies the normal range (no association to a clinical diagnosis of ASD) (Constantino & Gruber 2002). In this study, a cut-off point of ≥ 51 was chosen in order to discriminate children with and without ASD. This cut-off point is the preferred cut-off point based on research among clinical referrals (Visser et al. 2017).

The internal consistency, measured in an effect study by Charman et al. from 2007, showed that the SRS instrument had strong ability to identify ASD in an at-risk sample of 119 school-children aged 11-13 years (mean = 12.6 years; range 11.8-13.2) with special education needs. Specifically, among children (n = 75) with high IQ (≥ 70) the SRS showed a high sensitivity (mean = 0.78; range 0.61-0.91) and specificity (mean = 0.80; range 0.58-0.94) (Charman et al. 2007).

4.6.2 Reynolds Intellectual Assessment Scales (RIAS)

RIAS (Reynolds & Kamphaus 2003) is a test developed to assess intelligence in individuals across all developmental levels from 3-94 years old, which can be used for clinical as well as research purposes. Based on four subtests, RIAS estimates the Verbal Intelligence Index and the Non-verbal Intelligence Index in order to measure the general intelligence level, the so called General Intelligence Index (GII). RIAS is an effective intelligence test in relation to time consumption, costs and procurement of information. For instance, the test can predict basic vocational performance at same level to tests that are twice as time consuming (Psychological Assessment Resources 2011). In
this study, RIAS was administered by experienced psychologists from CFA, and took approximately 30 minutes to administrate.

4.7 Diagnostic instruments

The diagnostic instruments used in this study comprise Autism Diagnostic Observation Schedule-2 (ADOS-2; Lord et al. 2012) and Autism Diagnostic Interview-Revised (ADI-R; Rutter et al. 2003), which are the currently most acknowledged diagnostic tools. These two instruments are developed for administration by experienced professionals and can be applied in order to establish the diagnosis.

4.7.1 Autism Diagnostic Observation Schedule-2 (ADOS-2)

ADOS-2 (Lord et al. 2012) is a semi-structured standardised observation of behaviour, including communication, social interaction, imaginative use of materials and repetitive behaviour in people who may have ASD. ADOS-2 is a revised version of ADOS (Lord et al. 2000), which has been acknowledge as “gold standard” research method for diagnosis of ASD (Rudra et al. 2017; Ozonoff et al. 2005)

In the current study, ADOS-2 was administered in 14 cases by two professional and experienced examiners specialised in clinical child neuropsychology, who had sufficient reliability for research, administration and coding.

ADOS-2 consists of five modules; Toddler-module and module 1-4, that individually takes 30-60 minutes to administrate. Each module includes activities tailored children or adults at different developmental and verbal levels, from 12 months old without expressive verbal language (toddler-module) to adolescents/adults with fluent verbal language (module 4). The examiners chose the module estimated to match the studied individual best, based on expressive verbal skills and age. Module 3 and 4 are targeted individuals with fluent verbal language. In general, Module 3 is most applicable to children and young adolescents (<16 years), whereas Module 4 is more appropriate for adolescents and adults. The main differences between these two modules, is the inclusion of observations through interactive games in Module 3, whereas Module 4 is only centred on interview questions and conversation (Lord et al. 2012, p.13; Joseph et al. 2016, pp.41-45). In the current study, both Module 3 and 4 was used.
4.7.2 Autism Diagnostic Interview-Revised (ADI-R)

The ADI-R (Rutter et al. 2003) is a modified version of the Autism Diagnostic Interview (ADI; Le Couteur et al. 1989) a standardised, semi-structured, investigator-based interview for caregivers of individuals for whom ASD is a possible diagnosis (Lord et al. 1994). ADI-R assesses the developmental history and current day-to-day behaviour of the individual and is the current “gold standard” for establishing a clinical diagnosis of autism and related disorders (ASD) in children and adolescents (Rutter et al. 2005; Joseph et al. 2016, pp.42-44). The mental age of the assessed individual must be at least 2 years, as this is the age where the interview has demonstrated validity (Rutter et al. 2005). ADI-R includes 93 statements, which requires approximately 90-180 minutes to complete by an experienced clinical interviewer (Constantino & Gruber 2002, p.33; Joseph et al. 2016, pp.42-44). In this study, the diagnostic algorithm based on DSM-4 criteria for ASD was converted into DSM-5 criteria.

4.8 Tests

Three different tests were used to examine the effect of the TTT program on measured level of knowledge, self-concept and sexual behaviour. These include a knowledge test developed by (Hendriks & Meijs 2005), the Beck Self-Concept Inventory for Youth (BSCI-Y; Beck et al. 2005) and the Child Behaviour Checklist (CBCL; Achenbach & Rescorla 2001).

4.8.1 Psychosexual Knowledge Test (PKT)

The applied psychosexual knowledge test for adolescents (PKT; Dekker et al. 2015) is an adapted version of an existing Dutch high school biology test considering psychosexual knowledge for 13-15 years old adolescents attending pre-vocational education. The test contains 35 multiple choice questions and two open-ended questions (Dekker et al. 2015). The multiple-choice items examine the understanding of sexual terminology (e.g. ‘What does ‘fertilisation’ mean?’), knowledge on functionality of sex organs (e.g. ‘What happens when an egg cell is not fertilised?’), knowledge on safe sex (e.g. ‘Which statement regarding sexual transmitted diseases are false?’) and applied psychosexual knowledge (e.g. ‘Why is it important to make eye contact during social interaction?’), whereas the open-ended questions include illustrations of four male and female reproduction body-parts that that have to be named in a correct manner. Each item is rated as either ‘correct’ (1 point) or ‘incorrect’ (0 points) giving a total score of maximum 37 point. The adolescents were able to ask
questions for clarification, but did not receive feedback on the specific answers to avoid a learning effect which could possibly influence post-training measurements.

4.8.2 The Beck Self-Concept Inventory for Youth (BSCI-Y)
The Beck Youth Inventory Second Edition (BYI-2; Beck et al. 2005) includes five self-report instruments with the purpose to assess youth’s perception of depression, anxiety, anger, regressive behaviour and self-concept associated with emotional and social disability among children and adolescents. In the current study, the Beck Self-Concept Inventory for Youth (BSCI-Y; Beck et al. 2005) was applied. BSCI-Y includes 20 different statements about thoughts, feelings and behaviour, which are associated with self-concept and self-confidence in relation to feelings of competence, activeness and positive self-worth among children and adolescents. At each question the adolescent indicate how often the statements are matching their feelings, thoughts and behaviour. The language used in each item is formulated to second-class children, making it easy to understand. The adolescents’ responses were compared with the norm group consisting of results from 1500 Danish children and adolescents in the age from 7-18 years. As it can be difficult for adolescents to express feelings and thoughts, one major strength of the BYI is the help for the adolescent to take a stand by confirming or rejecting statements, without a need for individual formulation. Moreover, the BYI scales include important questions, in order to support the professional part in covering all aspects of the life of the adolescents (Beck et al. 2005).

4.8.3 Child Behaviour Checklist (CBCL)
The Sex Problems scale of the CBCL was used to determine changes in psychosexual problems. This scale consists of five items (‘playing with own genitals in public’; ‘playing too much with own genitals’; ‘sexual problems’; ‘very preoccupied of sex’; ‘desire to be from the other gender’). All items are rated by parents on a 3-point scale as either ‘not true’ (0 point), ‘somewhat or sometimes true’ (1 point) or ‘very true or often true’ (2 points) giving a maximum score of 10 points, with higher scores indicating more psychosexual problems (Achenbach & Rescorla, 2001; Letourneau, Schoenwald, & Sheidow, 2004).

4.8.4 Teen Transition Inventory (TTI):
The TTI (Dekker et al. 2017) is a self-report (186 items) and a parent-report (148 items) questionnaire collected among all participants in this study. Both questionnaires take approximately
one hour to complete (in this study about 1.5 hour) and cover different transitions in puberty, including nine scales addressing psychosexual functioning and psychosexual problems (Dekker et al. 2017). In addition to the PKT (self-report), the Sex Problem scale of the CBCL questionnaire (self-report) and the BSCI-Y questionnaire (parent-report), the two domains psychosexual behaviour and psychosexual selfhood were supposed to be assessed by the TTI questionnaire at T1, T2 and T3 by use of the three following scales; Psychosexual knowledge (parent-report and self-report), Amount of inappropriate sexualized behavior (parent report: 6 items e.g. “My child touches people in places where the other does not want to be touched”, self-report: 3 items e.g. “I keep contacting someone, even though that person has indicated he/she does not want any contact with me”), and Self-esteem (self-report: 12 items e.g. “I am happy with myself as a person”). All items would have been scored on a 3-point scale with ‘not at all true’ (0 points), ‘somewhat or sometimes true’ (1 point) and ‘definitely or often true’ (2 points). Though, due to limited rigorous investigation to both assess the quality of TTI and to revise the instrument (Dekker et al. 2017), the large TTI questionnaire was finally decided to be left out for further analysis in this study.

4.9 Participant flow and baseline characteristics

Figure 3 provides the CONSORT 2010 Flow Diagram of this study, illustrating participant flow throughout the study. In total, 64 adolescents (ASD: n = 30, TD peers = 34) were recruited to the study.
4.9.1 Adolescents with ASD

One of the referred adolescents with ASD were excluded due to low IQ, leaving 29 adolescents with ASD to participate in the study. Out of the 29 adolescents with ASD that completed the baseline measurement (T1), 16 adolescents (55%) participated posttreatment (T2) (males n = 11, females n = 5) and 13 (45%) participated at follow-up (T3). Because parents were given the choice to participate separately in addition to their child, 29 parents participated at baseline (T1), 12 parents (41%) participated posttreatment (T2), and 13 parents (45%) participated at follow-up (T3). In total, 48 percent of the participants (n = 14) dropped out of the study, due to personal circumstances (e.g. lack of motivation of the adolescent). The 16 adolescents that completed the TTT program followed all 18 sessions in the training program of which some sessions were adjusted to the individual needs.
4.9.2 Typical developed peers

In the interest of exploring the association between psychosexual knowledge measured at T1, T2 and T3 in adolescents with ASD who have participated in the TTT program and psychosexual knowledge in a comparable group of TD peers (aged 12-17 years) from the general population, TD peers were recruited to participate in this study. A total of eight secondary schools with 12-15 years old TD students (6th to 9th grade) were requested to participate though personal telephone interviews with the school secretary. These schools were selected based on the average marks reported in the 9th grade mandatory exams for males and females in 2015/2016. Estimates reported by the Danish Ministry of Education, show that the average mark at national level was 7.2 measured on a seven-point scale (-3 to 12), which matched the average marks reported in all selected secondary schools (7.0-7.4) (Undervisnings Ministeriet 2016). The selected secondary schools were located in Ballerup Municipality (n = 4), Herlev Municipality (n = 2), Frederiksberg Municipality (n = 2) and Gentofte Municipality (n = 2). Moreover, one upper secondary school (Kildegårdsskolen) with 16-17 years old TD students (10th grade) in Herlev Municipality was selected for this study. The average mark (seven-point scale) in 10th grade’s mandatory exams (level FP10, FP9) reported in 2015/2016 on Kildegårdsskolen was equal to the national average (UNI-C Statistik & Analyse 2017). Lastly, six high-schools with 16-17 years old TD students (1st and 2nd year) were requested to participate in the study, also selected based on average marks in mandatory exams equal to the national average.

In total three schools refused to participate due to limited resources or difficulty to manage the test in the school schedule, and eleven schools did not reply on the e-mail requests or follow-up forwarded by the school secretary. Thus, only 34 TD peers were recruited from the two schools; Kildegården School (10th grade, n = 16) situated in Herlev Municipality and Skovlunde School South (8th grade, n = 18) situated in Ballerup Municipality, both located in the Capital Region of Denmark.

An online version of the PKT was distributed and introduced to the TD peers in classroom by their teacher. Result of data analysis show that the mean score in the PKT in Skovlunde School 8th grade was 27.89 out of maximum 37 and all students completed the full questionnaire. Contrary, the mean score in the PKT was 16.63 points out of maximum 37 in Kildegårdsskolen 10th grade and only 13
out of 16 students completed the full questionnaire, whereas three students answered to approximately half of the questions.

Due to limited recruitment of TD peers, questionable quality of data and low representativeness of the study population (TD adolescents aged 12-17 years old) the collected data of the TD peers will not be assessed any further in this study.

5.0 Analysis

5.1 Background variables

Background variables including specific age, intelligence level (RIAS), ASD diagnosis (ADOS-2, ADI-R and SRS) were measured and analysed to provide a detailed description of the sample at baseline. The findings are presented in section 6.1 (p.57).

5.2 Outcome variables

The outcome variables; PKT, BSCI-Y, and CBCL Sex Behaviour Scale, were measured and analysed in order to reject or accept the hypotheses related to each research objective. To reach an objective decision as to whether particular hypotheses can be confirmed by the dataset, there must be an objective procedure for either rejecting or accepting that hypothesis. The objectivity is underlined because it is an important part of the scientific method to make conclusions based on methods that are public and which may be repeated by other investigators (Siegel & Castellan 1988, p.6). The presented current knowledge on psychosexual education provided to teenagers supports the null hypothesis, i.e. that there is no association between receiving the full TTT program and increased psychosexual knowledge.

5.2.1 Hypotheses

In the current study the following three hypotheses are tested:

1. The first H₀ is that μ₁ = μ₂, that is, the mean PKS (37 items) in the TTT participants at T1 and T2 and at T2 and T3 is the same. The alternative hypothesis (Hₐ) is that μ₁ ≠ μ₂, that is, the mean PKS in the TTT participants at T1 and T2 and at T2 and T3 is not the same. Hₐ with μ₁ ≠ μ₂ is chosen over μ₁ < μ₂ because it is possible that some participants will become confused after all the training and start to mix things up when answering the 37 questions.
This could actually lead to a decreased score, so it is not possible to assume that if there is change then the change will be in a positive direction, which is what e.g. $\mu_1 < \mu_2$ implies. Therefore, a two-tailed test is used. This is the primary outcome variable of the study.

2. The second $H_0$ is that $\mu_1 = \mu_2$, that is, the mean T-score in the BSCI-Y test (20 items) among the TTT participants at T1 and T2 and at T2 and T3 is the same. $H_A$ is that $\mu_1 \neq \mu_2$, that is, the mean T-score in the BSCI-Y test reported by the TTT participants at T1 and T2 and at T2 and T3 is not the same. Again, a two-tailed approach is used; this time because the training could theoretically have a negative impact on the self-concept of the participants due to increased awareness of ASD related disadvantages. For this reason, the BSCI-Y test is thought of as a secondary outcome variable.

3. The third $H_0$ is that $\mu_1 = \mu_2$, that is, the sum-score for each item in the CBCL Sex Problem scale (5 items) in the TTT participants at T1 and T3 is the same. $H_A$ is that $\mu_1 \neq \mu_2$, that is, the sum-score at T1 and T3 is not the same. Again, a two-tailed approach is used; this time because the training could theoretically have a negative impact on the sexual behaviour of the participants due increased focus on psychosexual functioning. For this reason, the CBCL Sex Problem scale is thought of as a secondary outcome variable.

5.2.2 Choice of statistical tests

Often alternative and valid statistical test are available for a particular research hypothesis, which is why it is necessary to retain some rationale for choosing among them. One consideration concerns the power of the test, i.e. if it has a large probability of rejecting $H_0$ when $H_0$ is false. Moreover, the concerns in relation to choice of the most appropriate statistical test for each hypothesis, also include the nature of the population from which the sample was drawn, the manner of sampling, and the kind of scaling in the variable (Siegel & Castellan 1988, pp.8,19).

When identifying the nature of the population and the manner of sampling a statistical model is founded. This model specifies the conditions under which the test is valid, often called assumptions of the test. The most powerful tests have the most extensive assumptions, i.e. the t test which is a parametric test. The following assumptions are elements of the parametric statistical model (Siegel & Castellan 1988, p.20):
1. The observations must be independent.
2. The observations must be drawn from a normally distributed population.
3. Populations must have the same variance, when analysing two groups.
4. The variables must be measured in at least an interval scale.

Parametric statistical tests are used when there is reason to believe that the above-mentioned conditions are met in the analysed data. According to George and Mallery (2010), the values for skewness $\pm 2$ are considered acceptable in order to prove normal univariate distribution (George & Mallery 2010).

By the use of SPSS Statistics, it can be seen that the data on psychosexual knowledge is normally distributed, which support the second assumption (see Table 12, p.64). Moreover, measurement has been achieved in the sense of an interval scale (assumption 4), which is characterized by the same meaning of same size intervals between any two ordered numbers (Siegel & Castella, 1988, pp.28-30). Thereby, a participant answering correctly to any item is exactly equal, and show the same amount of ability, to answering correctly to any other item. Since there is a reason to believe that the first assumption related to independent observations are appropriately met, and the third assumption is not relevant as only one group are analysed, the data set achieves all relevant assumptions (1, 2 and 4), which is why a t test (described further in section 5.2.2.1, p.55) will be used when testing the first hypothesis (c.f. section 5.2.1, p.52). In addition, the parametric test of correlation, Pearson’s r, will be produced to assess the correlation between change in PKS from T1 to T2, and specific age measured by date of birth and date of T1 self-report assessment (described further in section 5.2.2.3, p.56).

In relation to the second and third hypothesis of the current study, assumption 4 will first be addressed. In relation to the used questionnaires concerning self-esteem and sex problems, measurements are ordered in the sense that the participants respond to items of the BSCI-Y and CBCL Sex Problem Scale by use of a four- and three-point scale, respectively (i.e. ‘newer’, ‘sometimes’, ‘often’ and ‘always’). Thus, number from 0-3 or 0-2 is assigned to each response indicating an order or rank of agreement, corresponding to ordinal scale(Brace et al. 2003) (Brace et al. 2003, p.5). Therefore, there is no valid reason to believe that the dataset related to the second and third hypothesis of this study meet assumption 4, which is why parametric tests are considered
inappropriate to use on these data. Instead, it is relevant to choose other statistical tests with fewer assumptions and none of which imply a normal distribution, which are elements of the non-parametric statistical model (Siegel & Castellan 1988, pp.20-21). Non-parametric statistical tests are useful when the sample size is very small, and when the data are inherently in ranks. They should be used in preference to the equivalent \( t \) tests under the following circumstances (Brace et al. 2003, p.71):

1. The variables must only be measured in an ordinal scale.
2. If data are interval or ratio, but abnormally distributed (e.g. severely skewed).
3. If the data are interval or ratio, but the variance of the two samples do not meet an equality of variance test.

Thus, the non-parametric tests; Wilcoxon signed ranks (described further in section 5.2.2.2, p.55), equivalent to the parametric \( t \) test, will be used in order to test the second and third research hypothesis in this study.

5.2.2.1 \( T \) test

The \( t \) test is a parametric test used to determine whether two means are significantly different from one another. There exist three types of \( t \) tests; the single sample \( t \) test, the independent \( t \) test and the paired \( t \) test. Both the single sample \( t \) test and the independent \( t \) test will not be dealt with in this study. Instead, the paired \( t \) test with a repeated measures design is applied for testing the first hypothesis, as it wants to compare the means of two sets of observations of the psychosexual knowledge (dependent variable) in the same participants at different points in time (T1 and T2; T2 and T3; T1 and T3) (independent variables). The test considers pairs of data together, which is why the test is known as a paired \( t \) test (Brace et al. 2003, pp.62,67).

5.2.2.2 Wilcoxon signed ranks test

The Wilcoxon signed-ranks test is a non-parametric test equivalent of the paired \( t \) test, used for data from repeated measures and matched pairs design in order to test whether two samples are significantly different. It gives judgements on the sign of the difference score between two values (e.g. \( X = \) BSCI-Y T-score at T1, \( Y = \) BSCI-Y T-score at T2) in any pair, and ranks the difference scores (\( d_i \)) in order of absolute size. Thus, not only the direction is considered, but also the relative magnitude. In addition, the Mann-Whitney U test is the non-parametric test equivalent to the independent \( t \) test, comparing data collected in an independent groups design, which will not be
relevant to this study (Brace et al. 2003, p.71; Siegel & Castellan 1988, p.87). For each matched pair of observations, \(X_i\) and \(Y_i\), the signed difference score \(d_i\) between the two variables are determined:

\[
d_i = X_i - Y_i
\]

If \(H_0\) (c.f. section 7.2.1 b. and 7.2.1 c.) is true, some of the larger ranks would come from positive \(d_i\)’s (+ sign), whereas others would come from negative \(d_i\)’s (- sign). Thereby, it is expected that the sum those two ranks would be approximately equal. Contrary, if the sums differ very much from each other, it would be inferred that \(X\) differs from \(Y\), and, so, \(H_0\) would be rejected.

To develop a test, the sum of all the ranks of the positive and the negative signed \(d_i\)’s \((T^+ \text{ and } T^-, \text{ respectively})\) must be determined:

\[
\frac{N(N + 1)}{2}, T^- = \frac{N(N + 1)}{2} - T^+
\]

The procedure for determining the significance of the measured \(T^+\) depends on the size of \(N\) (the number of nonzero \(d_i\)’s). If the probability associated with the observed value of \(T^+\) is less than or equal to the chosen significance level, \(H_0\) can be rejected. For small samples, the power efficiency of the Wilcoxon signed ranks test is nearly 95 of the parametric \(t\) test (Siegel & Castella, 1988, pp.87-95).

### 5.2.2.3 Pearson’s correlation coefficient

Pearson’s correlation coefficient is produced to check if two interval variables are correlated. In the current study, a group of \(N\) participants are arranged e.g. in the order of their scores in the PKT and the order of their specific age measured by data of birth. If the participants’ age rankings are denoted as \(X_1, X_2, \ldots, X_N\) and the psychosexual knowledge rankings are represented by \(Y_1, Y_2, \ldots, Y_N\), a measure of rank-order correlation may be used to determine the relation between the X’s and the Y’s. The correlation between the individual PKS and age would be perfect if, and only if, \(X_i = Y_i\) for all \(i\)’s, that is, if each participant had the same ranking on both variables. Thus, an indication of the difference \((d_i)\) between the two sets of rankings are the following:

\[
d_i = X_i - Y_i
\]

As an example, participant ID no. 26 received the largest ranking in the knowledge test at T1 \((Y_{ID 26} = 16)\) and only the fourth largest score at the specific age ranking (c.f. date of birth) measured at T1 \((X_{ID 26} = 12)\). Therefore, ID no. 26’s \(d\) is 16 - 12 = 4. The level of the \(d_i\) gives an
idea of how close is the relation between the PKS at T1 and the participants’ specific age. Only if every relation between the two sets of ranks were perfect, all \( d \) would be zero. The larger the \( d_i \)’s, the less perfect the association between the two variables and the larger the index of difference between the rankings (Siegel & Castellan 1988, pp.235–36).

The detailed information on the analysis in this study, were the basis of the findings reported in the next chapter.

6.0 Findings

This chapter presents findings of this study on each background variable, followed by findings on each outcome variable. Descriptive statistics and inferential statistical tests presented in this chapter have been conducted in IBM SPSS Statistics version 22 (IBM United States Software Announcement 213-309 2013). Illustrations and tables were conducted in Microsoft Excel.

6.1 Background variables

This section presents descriptive statistics for all background variables including specific age, intelligence level (RIAS), and ASD diagnosis (ADOS-2, ADI-R and SRS).

6.1.1 Specific age

Presented in Table 7, the mean specific age of the participants (estimated by date of birth) were about 15.1 years (SD = 1.7, n = 15) at date of T1 self-assessment, 15.7 years (SD = 1.8, n = 15) at T2, and 16.2 years (SD = 1.9, n = 12) at T3. Moreover, at T1 the specific minimum age of the participants was 12 years and the maximum specific age was 17.6 years. At T2 the minimum specific age had increased to 12.8 years, and at T3 the youngest participant was 13.3 years-old. Likewise, the maximum specific age of the participants increased to 18.2 years at T2, and 18.7 years at T3.

Table 7: Descriptive statistics on specific age at T1, T2 & T3

<table>
<thead>
<tr>
<th></th>
<th>( T1 )</th>
<th>( T2 )</th>
<th>( T3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>15.1 (1.8)</td>
<td>15.7 (1.8)</td>
<td>16.2 (1.9)</td>
</tr>
</tbody>
</table>
The age histogram below (Figure 4) illustrate a normal distribution of specific age in the participants \((n = 16)\) measured at baseline. 12.50 percent of the participants \((n = 2)\) were 12 and 15 years old, respectively, and 18.75 percent \((n = 3)\) were 13, 14, 16, and 17 years, respectively.

*Figure 4: Age histogram*
6.1.2 RIAS

Figure 5: RIAS index in TTT participants at T1 (n = 15)

Figure 5 shows the estimated general intelligence index (GII) (y-axis) of the participants (n = 15) (x-axis). The sample mean GII is 100.67. According to *RIAS 2003 Scheme of Verbal Descriptors of Intelligence Test Performance* (Reynolds & Kamphaus 2003, p.3) the average range of GII is from 90-109. Thus, the mean RIAS index in this sample is in the average range.

At individual level, eight participants (about 33.3%) had a RIAS index in the average range (90-119) two participants (about 13.3%) had a RIAS index in the above average range (110-119), two participants (about 13.3%) had a RIAS index moderately above average (120-129), two had a RIAS in the below average range (80-89) and the final participant had a RIAS index in the moderately below average range (about 6.7%) (Reynolds & Kamphaus 2003, p.3).

Additionally, one participant had a WISC-V GII score at 112 (CI 104;114), which is equally in the above average range.
6.1.3 ADOS-2

Table 8: Descriptive statistics on ADOS-2 at T1 (n = 14)

<table>
<thead>
<tr>
<th>ID</th>
<th>Module</th>
<th>Total (SA + RR) raw-score</th>
<th>Calibrated severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>3</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>22</td>
<td>3</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>23</td>
<td>3</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>26</td>
<td>4</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>

SA: social affective behaviour, RR: restricted and repetitive behaviour, red colour = non-spectrum.

Table 8 indicates which module each participant was given, the total raw-score of the social affective behaviour (SA) and restricted and repetitive behaviour (RR), and the correspondent calibrated severity score. Based on estimated total raw-scores, 9 participants (64.3%) were classified with either an autism spectrum disorder or autism, whereas 5 participants (35.7%, ID no. 2, 5, 7, 11, 26) were classified in the non-spectrum category. In addition, measures of the calibrated severity score indicate that 10 participants (71.4%) were classified to have low to high level of ASD related symptoms or Autism spectrum disorder (DSM-5), while 3 participants (7.1%, ID no.: 5, 7, 26) were categorised non-spectrum or as having minimal level to no ASD related symptoms.

More specifically, in the younger half of the participants who received module 3 (n = 7), the mean total SA + RR raw-score was 9.71 indicating an autism diagnosis (cut-off ≥ 9 = autism/infantile autism; 7-8 = ASD; ≤ 6 = non-spectrum) and the mean calibrated severity score was 5.57, indicating moderate ASD severity (cut-off 1-2 = minimal level to no ASD related symptoms; 3-4 =
low level of ASD related symptoms; 5-7 = moderate level of ASD related symptoms; 8-10 = high level of ASD related symptoms). In the participants receiving module 3, three participants (about 42.9%) were assessed to be in the non-spectrum category (ID no. 2, 5 and 11) based on at least one parameter (total SA+RR raw-score and/or calibrated severity score).

The older half of the participants who received module 4 (n = 7), had a mean total SA + RR raw-score of 11.86 indicating an ASD diagnosis (cut-off ≥ 8 = ASD; ≤ 7 = non-spectrum) and an estimated calibrated severity score of 5.86, which indicate a ASD diagnosis based on DSM-5 criteria (4-10: ASD (DSM-5); 1-3: non-spectrum). In the participants receiving module 4, two participants (about 28.9%) were assessed to be in the non-spectrum category (ID no. 7 and 26) based on at least one parameter (total SA+RR raw-score and/or calibrated severity score).

It is important to underline, that results of ADOS-2 cannot stand alone in an ASD diagnosis, which is why ADI-R and SRS were also measured.

6.1.4 ADI-R
Table 9: Descriptive statistics on ADI-R at T1 (n = 14)

<table>
<thead>
<tr>
<th>ID</th>
<th>A total</th>
<th>B verbal, total</th>
<th>C total</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>18</td>
<td>13</td>
<td>3</td>
<td>ASD</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>15</td>
<td>6</td>
<td>ASD</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>9</td>
<td>1</td>
<td>2/3</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
<td>13</td>
<td>5</td>
<td>ASD</td>
</tr>
<tr>
<td>7</td>
<td>16</td>
<td>19</td>
<td>6</td>
<td>ASD</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>17</td>
<td>3</td>
<td>ASD</td>
</tr>
<tr>
<td>11</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>2/3</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>14</td>
<td>2</td>
<td>2/3</td>
</tr>
<tr>
<td>15</td>
<td>22</td>
<td>19</td>
<td>5</td>
<td>ASD</td>
</tr>
<tr>
<td>16</td>
<td>15</td>
<td>17</td>
<td>11</td>
<td>ASD</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>14</td>
<td>3</td>
<td>ASD</td>
</tr>
<tr>
<td>22</td>
<td>8</td>
<td>16</td>
<td>2</td>
<td>1/3</td>
</tr>
<tr>
<td>23</td>
<td>9</td>
<td>6</td>
<td>2</td>
<td>0/3</td>
</tr>
<tr>
<td>26</td>
<td>16</td>
<td>17</td>
<td>5</td>
<td>ASD</td>
</tr>
</tbody>
</table>
A total: qualitative deviance in reciprocal social interaction, B verbal: total: qualitative deviance in communication, C-total: restricted, repetitive and stereotypic pattern in behaviour, red colour = non-spectrum.

Table 9 shows the estimated total scores of A (qualitative deviance in reciprocal social interaction), B verbal (qualitative deviance in communication) and C (Restricted, repetitive and stereotypic pattern in behaviour) assessed per each participant (n = 14). In total, 9 participants have met the cut-off point for an ASD diagnosis. Contrary, five participants (about 35.7%, ID no. 5, 11, 13, 22 and 23) were assessed to be in the non-spectrum category based on at least one parameter, A total, B verbal total or C-total, giving the set cut-off point, which is 10, 8 and 3, respectively. In the last column, the interpretation of the total scores are presented, indicating if the particular participants are categorised with an ASD diagnosis (meeting all three cut-off points = ASD), or on how many parameters they have met the cut-off points (0-2 parameters out of 3).

It is important to underline, that results of ADI-R cannot stand alone in an ASD diagnosis, so even if no cut-off points are met in ADI-R (ID no. 23), the individual can still be diagnosed with ASD based on other tests (e.g. ADOS-2 and SRS in the case of ID no. 23) and a clinical assessment.

6.1.5 SRS

6.1.5.1 Descriptive statistics

Table 10: Descriptive Statistics on SRS T-scores at T1

<table>
<thead>
<tr>
<th>T1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>13</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>70.7 (12.3)</td>
</tr>
</tbody>
</table>

Table 10 presents the estimated mean total SRS T-score, which was about 70.7 (SD = 12.3) in 13 participants at T1
Figure 6: SRS total T-scores in TTT participants at T1

![Graph showing SRS total T-scores in TTT participants at T1 (n = 13)](image)

Y-axis: SRS total score; x-axis: number of participants; M: mean, NR: normal range; MM: mild to moderate range; S: severe, strong association to ASD diagnosis.

Figure 6 show the total SRS total T-score at T1 (n = 13) at individual level and the mean score, respectively. Thereby, these estimates indicate that the participants in general had a mild to moderate (MM) association to a clinical diagnosis of ASD at T1.

More specifically, at T1 five participants (about 38.5%) scored 76 or more, which indicates severe, strong association to a clinical diagnosis of ASD. In addition, five participants (about 38.5%) scored 60-75 at T1, which indicates mild to moderate association to a clinical diagnosis of ASD. Finally, at T1 three (about 23.1%) participants scored 59 or below, which indicates the normal range.

6.1.5.2 Pearson’s correlation test

Table 11: Correlation matrix on ADI-R and SRS at T1

<table>
<thead>
<tr>
<th></th>
<th>SRS T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADI-R</td>
<td>Pearson Correlation</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
</tbody>
</table>

*: Correlation is significant at the 0.05 level (two-tailed).

The correlation matrix (Table 11) shows that there was a statistical significant correlation between SRS scores and ADI-R total domain scores at T1 ($r = -0.636$, $n = 13$, $p = 0.020$, two-tailed).
In sum, for the current study, no formal clinical diagnosis was available for the participants who completed the training but for all these participants it was the case that they had an elevated score indicating ASD on either the SRS, ADOS or the ADI-R.

6.2 Outcome variables
The findings of the outcome variables include descriptive statistics and inferential statistical tests for the primary outcome variable, “psychosexual knowledge (PKT)”. Next, descriptive statistics and statistical tests are presented on the secondary outcome variable “positive self-concept (BSCI-Y)”, followed by descriptive statistics of the other secondary outcome variable “sex behaviour problems (CBCL Sex Problem scale)”.

6.2.1 Psychosexual knowledge

6.2.1.1 Descriptive statistics
Table 12 show the descriptive statistics including measures of central tendency (i.e. mean) and dispersion (i.e. minimum, maximum, standard deviation (SD) and variance) in the data set of the level of psychosexual knowledge in the participants with ASD measured at T1, T2, and T3.

Table 12: Descriptive Statistics on Psychosexual Knowledge Scores at T1, T2, & T3

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>14</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>21.2 (8.8)</td>
<td>30.4 (4.1)</td>
<td>31.2 (3.9)</td>
</tr>
<tr>
<td>Skewness</td>
<td>-.4</td>
<td>-1.3</td>
<td>-1.8</td>
</tr>
<tr>
<td>Min.</td>
<td>7</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Max.</td>
<td>32</td>
<td>35</td>
<td>35</td>
</tr>
</tbody>
</table>

The average PKS reported in 14 participants at T1 is about 21.2 (SD = 8.8). In comparison, the PKS reported in 16 participants at T2 is about 30.4 (SD = 4.1). Thus, the average increase in the PKS from baseline to post-training assessment is approximately 43.4 percent. Additionally, at T3, the average PKS reported in 13 participants is about 31.2 (SD = 3.9). Therefore, the average increase in the PKS from post-training to six months’ follow-up assessment is approximately 2.6 percent. Moreover, the average increase in PKS reported in adolescents with ASD from baseline to six
months’ follow-up is about 47.2 percent. The estimates mean PKS assessed in the TTT participants at T1, T2, and T3 are presented in Figure 7.

Figure 7: Mean of Psychosexual Knowledge scores measured in TTT participants at T1, T2 & T3

In addition, Table 12 indicate dispersion at T1 measured by a PKS at min. 7 points and max. 32 points out of a total of maximum 37 points. In comparison, the minimum PKS reported at T2 and T3 is 21 points, which indicate a 200 percent increase from T1 to T2 and zero percent increase (steady minimum) from T2 to T3. Thereby, the minimum score has increased threefold from T1 to T2 and T1 to T3. Moreover, the maximum PKS reported at T2 and T3 is 35 points. Thus, the maximum PKS has increased about 9.3 percent from T1 to T2 and from T1 to T3.

Finally, the descriptive statistics indicate that the dataset on psychosexual knowledge are approximately normally distributed due to the fact that the measured skewness is within the range from -2 to +2 (T1: -0.4; T2 = -1.3; T3 = -1.8) (George & Mallery 2010).

In order to obtain descriptive statistics on all participants, frequency table outputs are produced in SPSS, showing the number of participants who have a specific PKS at T1, T2 and T3.
Table 13: Frequencies in Psychosexual Knowledge Scores at T1

<table>
<thead>
<tr>
<th>PKS (max. 37)</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid percent</th>
<th>Cumulative percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>7.1</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>14.3</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>21.4</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>28.6</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>35.7</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td>3.0</td>
<td>14.3</td>
<td>50.0</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>57.1</td>
</tr>
<tr>
<td>28</td>
<td>2</td>
<td>3.0</td>
<td>14.3</td>
<td>71.4</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>78.6</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>85.7</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>92.9</td>
</tr>
<tr>
<td>32</td>
<td>1</td>
<td>1.5</td>
<td>7.1</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>21.2</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

The frequencies table above (Table 13), indicate the dependent variable “psychosexual knowledge score (PKS)” (max. 37 points) measured at T1, and the frequency column tells the dependent variable “number of participants”. The percent column, indicate the percentage of participants who received a certain PKS, and the valid percent column shows the percentage adjusted for any missing cases. In sum, the cumulative percent column show that 50 percent of the participants scored maximum 20 out of max. 37 points, whereas the other 50 percent of the participants got a PKS larger than 20 points out of max. 37 points, assessed by the PKT at T1. Likewise, the following frequency tables (Table 14 and Table 15), present the number of correct answers measured at T2 and T3.

Table 14: Frequencies in Psychosexual Knowledge Scores at T2

<table>
<thead>
<tr>
<th>PKS at T2 (max. 37)</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid percent</th>
<th>Cumulative percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>1</td>
<td>1.5</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>1.5</td>
<td>6.3</td>
<td>12.5</td>
</tr>
<tr>
<td>27</td>
<td>1</td>
<td>1.5</td>
<td>6.3</td>
<td>18.8</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
<td>1.5</td>
<td>6.3</td>
<td>25.0</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>1.5</td>
<td>6.3</td>
<td>31.3</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>1.5</td>
<td>6.3</td>
<td>37.5</td>
</tr>
<tr>
<td>31</td>
<td>2</td>
<td>3.0</td>
<td>12.5</td>
<td>50.0</td>
</tr>
<tr>
<td>32</td>
<td>1</td>
<td>1.5</td>
<td>6.3</td>
<td>56.3</td>
</tr>
<tr>
<td>33</td>
<td>5</td>
<td>7.6</td>
<td>31.3</td>
<td>87.5</td>
</tr>
</tbody>
</table>
In the cumulative percent column in Table 10, it is shown that 50 percent of the participants scored maximum 31 points in the PKT, whereas the other 50 percent got a PKS larger than 31 points out of max. 37 points, assessed by the PKT at T2.

Table 15: Frequencies in Psychosexual Knowledge Scores at T3

<table>
<thead>
<tr>
<th>PKS at T3 (max. 37)</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid percent</th>
<th>Cumulative percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>1</td>
<td>1.5</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>1.5</td>
<td>7.7</td>
<td>15.4</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
<td>3.0</td>
<td>15.4</td>
<td>30.8</td>
</tr>
<tr>
<td>32</td>
<td>3</td>
<td>4.5</td>
<td>23.1</td>
<td>53.8</td>
</tr>
<tr>
<td>33</td>
<td>2</td>
<td>3.0</td>
<td>15.4</td>
<td>69.2</td>
</tr>
<tr>
<td>34</td>
<td>3</td>
<td>4.5</td>
<td>23.1</td>
<td>92.3</td>
</tr>
<tr>
<td>35</td>
<td>1</td>
<td>1.5</td>
<td>7.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>19.7</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

In the cumulative percent column in Table 15, it is shown that 53.8 percent of the participants scored maximum 32 points in the PKT, whereas the other 46.2 percent got a PKS at more than 32 points out of max. 37 points, assessed by the PKT at T3.

6.2.1.2 Paired t test

Table 16: Paired samples statistics on Psychosexual Knowledge Scores at T1 & T2

<table>
<thead>
<tr>
<th>PKS at T1 &amp; T2</th>
<th>t</th>
<th>df</th>
<th>Sig. (two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-4.2</td>
<td>13</td>
<td>.001</td>
</tr>
</tbody>
</table>

df: degrees of freedom, sig. (two-tailed): p-value.

Explained by the output of a paired samples t test presented in Table 16, the PKS was strongly significantly higher for participants assessed at T2 than at T1 ($t = 4.2$, df = 13, $p = 0.001$, 2-tailed) measured by a 95 percent confidence interval. Thus, this paired t test accepts $H_A$ and rejects the $H_0$ by determining a strong significant difference between the mean of PKS assessed by the PKT at T1 compared to T2.
Table 17: Paired differences of Psychosexual Knowledge Scores at T1 & T3

<table>
<thead>
<tr>
<th>PKS at T1 &amp; T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
</tr>
<tr>
<td>df</td>
</tr>
<tr>
<td>Sig. (two-tailed)</td>
</tr>
</tbody>
</table>

df: degrees of freedom, sig. (2-tailed): p-value.

The paired samples t test presented in Table 17, indicate that the PKS was strongly significantly higher for participants assessed at T3 than at T1 (t = 5.1, df = 12, p < 0.0005, 2-tailed) measured by a 95 percent confidence interval. Thereby, this paired t test accepts Hₐ and rejects H₀ by determining a strong significant difference between the mean PKS assessed by the PKT at T1 compared to T3.

Although the two t tests above (Table 16 & Table 17) accepts Hₐ and rejects H₀, it is not the case that Hₐ is true, as the data only permit to make probabilistic statements concerning the hypotheses.

Table 18: Paired differences of Psychosexual Knowledge Scores at T2 & T3

<table>
<thead>
<tr>
<th>PKS at T2 &amp; T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
</tr>
<tr>
<td>df</td>
</tr>
<tr>
<td>Sig. (two-tailed)</td>
</tr>
</tbody>
</table>

df: degrees of freedom, sig. (two-tailed): p-value.

Explained by the paired samples t test showed in Table 18, the PKS was not significantly higher for participants measured at T3 than at T2 (t = 0.4, df = 12, p = 0.697, 2-tailed) measured by a 95 percent confidence interval. Thus, the final t test accepts H₀ and rejects Hₐ by determining no significant difference between the mean PKS assessed by the PKT at T2 compared to T3.

6.2.1.3 Pearson’s correlation test

A correlational design was used in order to test the hypothesis if there would be a negative correlation between the change in level of psychosexual from T1 to T2 and specific age at T1 (n = 16). The two variables measured comprised the change in PKS from T1 to T2 (T2-T1; dependent variable) and the specific age at T1 (independent variable) measured by identified date of birth and date of completion of self-reported PKT. The specific age was measured by the specific date of self-reported PKT at T1 and parent-reported date of birth. Though, in one case (ID no. 15) the specific
age was measured by date of birth and the specific date of parent-reported T1 questionnaires, as data on the date of PKT completion at T1 had not been recorded. This single case of inconsistent specific age measurement was not expected to affect the results as the mean difference in specific age at T1 reported by adolescents versus parents was estimated to less than one day. In SPSS, a bivariate analysis was used to measure Pearson’s $r$.

Table 19: Correlation matrix on change in Psychosexual Knowledge Scores and specific age at T1

<table>
<thead>
<tr>
<th>Specific age* T1</th>
<th>PKS T2-T1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pearson Correlation</td>
</tr>
<tr>
<td></td>
<td>-.224</td>
</tr>
</tbody>
</table>

*: Specific age estimated at T1 (date of completion of self-reported PKT).

The correlation matrix (Table 19) shows that there was no statistical significant correlation (neither positive or negative) between PKS and specific age assessed at T1 ($r = -.224$, $n = 16$, $p = 0.405$, two-tailed).

6.2.2 Self-concept

6.2.2.1 Descriptive statistics

Descriptive statistics (Table 20) estimated in SPSS indicate that the average BSCI-Y T-score is about 44.0 (SD = 8.2) assessed in 16 participants at T1. In comparison, the average BSCI-Y T-score is about 50.4 (SD = 8.8) assessed in 15 participants at T2. Thus, the average level of self-concept in the TTT participants assessed by the BSCI-Y test has increased by approximately 14.2 percent from baseline to post-training assessment.

In addition, the descriptive statistics in Table 20 show an average BSCI-Y T-score equal to about 49.3 (SD = 10.1) assessed in 12 participants at T3. Thus, the average level of self-concept in the TTT participants assessed by the BSCI-Y test has decreased by approximately 2 percent from post-training to six months’ follow-up assessment. Moreover, the average level of self-concept in the TTT participants has increased by approximately 10.7 percent from baseline to six months’ follow-up assessment.
Table 20: Descriptive Statistics on BSCI-Y T-scores at T1, T2 & T3

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>16</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>44.0 (8.2)</td>
<td>50.3 (8.8)</td>
<td>49.3 (10.1)</td>
</tr>
<tr>
<td>Min.</td>
<td>33</td>
<td>34</td>
<td>36</td>
</tr>
<tr>
<td>Max.</td>
<td>66</td>
<td>69</td>
<td>66</td>
</tr>
</tbody>
</table>

M: mean; SD: standard deviation.

Figure 9 illustrates the estimated average BSCI-Y T-score (y-axis) assessed at T1, T2, and T3 (x-axis) and related ranges. According to Beck Youth Inventories (2nd ed.) (Beck et al. 2005) the “below average range” of BSCI-Y T-score is from 40-44. Thus, at baseline the mean BSCI-Y T-score in this sample is in the “below average range” when comparing to the norm group consisting of Danish adolescents with same age and gender.

Moreover, Beck Youth Inventories (2nd ed.) (Beck et al. 2005) indicate that the “average range” of BSCI-Y T-score is from 45-55. Thus, at post-training and six-follow-up assessment the mean BSCI-Y T-score in this sample is within the “average range” when comparing to the norm group consisting of Danish adolescents with same age and gender.

In sum, the mean level of self-concept measured in the TTT participants has increased from below average level to average level from baseline to post-training and six-months follow-up assessments.
Figure 9: Mean of BSCI-Y T-score measured in TTT participants at T1, T2 and T3

![Mean BSCI-Y T-scores measured in TTT participants](image)


### 6.2.2.2 Wilcoxon signed ranks test

**Table 21: Wilcoxon signed ranks test on BSCI-Y T-scores at T1 & T2**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Ranks</td>
<td>2a</td>
<td>11.5</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>12b</td>
<td>93.5</td>
</tr>
<tr>
<td>Ties</td>
<td>1c</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

a: T2 < T1, b: T2 > T1, c: T2 = T1

The ranks test presented in Table 21 above, indicate that 12 out of 15 participants (80 percent) increased their level of positive self-concept, 2 out of 15 participants (about 13 percent) decreased their level of positive self-concept, and 1 out of 15 participants (about 7 percent) reported same level of positive self-concept from T1 to T2. In addition, the test shows that sum of ranks for the negative ranks is 11.5, which is a lower estimate than the sum of ranks for the positive ranks that equals 93.5.
Table 22: Wilcoxon test statistics on BSCI-Y T-scores at T1 & T2

<table>
<thead>
<tr>
<th></th>
<th>BSCI-Y T-scores at T1 &amp; T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>-2.578&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.010</td>
</tr>
</tbody>
</table>

<sup>a</sup>: Based on negative ranks.

The test statistics of the Wilcoxon signed ranks test presented in Table 22, show that the estimated $p$ value of the two-tailed hypothesis equals to $p = 0.010$. Thereby, it can be concluded that there was a positive statistical significant difference between the level of self-concept measured by the BSCI-Y test at T1 and T2 ($z = 2.578$, $N – Ties = 14$, $p = 0.010$, two-tailed).

Table 23: Wilcoxon signed ranks test on BSCI-Y T-scores at T2 & T3

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Ranks</td>
<td>8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>39.0</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>39.5</td>
</tr>
<tr>
<td>Ties</td>
<td>0&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>: T3 < T2, <sup>b</sup>: T3 > T2; <sup>c</sup>: T3 = T2

Table 23 indicate that 4 out of 12 participants (about 33 percent) increased their level of positive self-concept, and 8 out of 12 participants (about 67 percent) decreased their level of positive self-concept from T2 to T3. Though, the test shows that sum of ranks for the negative ranks is 39.0, which is a slightly lower estimate than the sum of ranks for the positive ranks that equals 39.5.

Table 24: Wilcoxon test statistics on BSCI-Y T-scores at T2 & T3

<table>
<thead>
<tr>
<th></th>
<th>BSCI-Y T-scores at T2 &amp; T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>-0.000&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

<sup>a</sup>: Based on negative ranks.

In Table 24 above, the test statistics of the Wilcoxon signed ranks test for BSCI-Y T-scores at T2 and T3 show that the estimated $p$ value of the two-tailed hypothesis equals to $p = 1.000$. Thus, it can be concluded that there was a no statistical significant difference between the level of self-concept measured by the BSCI-Y test at T2 and T3 ($z = 0.000$, $N – Ties = 12$, $p = 1.000$, two-tailed).
Table 25: Wilcoxon signed ranks test on BSCI-Y T-scores at T1 & T3

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Ranks</td>
<td>3a</td>
<td>14.0</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>8b</td>
<td>52.0</td>
</tr>
<tr>
<td>Ties</td>
<td>1c</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

a: T3 < T1, b: T3 > T1, c: T3 = T1

The ranks test presented in Table 25 indicate that 8 out of 12 participants (about 67 percent) increased their level of positive self-concept, 3 out of 12 participants (25 percent) decreased their level of positive self-concept, and 1 out of 12 participants (about 8 percent) reported same level of positive self-concept from T1 to T3. In addition, the test shows that sum of ranks for the negative ranks is 14.5, which is a lower estimate than the sum of ranks for the positive ranks that equals 52.0.

Table 26: Wilcoxon test statistics on BSCI-Y T-scores at T1 & T3

<table>
<thead>
<tr>
<th></th>
<th>BSCI-T T-scores at T1 &amp; T3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Z</td>
</tr>
<tr>
<td></td>
<td>-1.690a</td>
</tr>
</tbody>
</table>

a: Based on negative ranks.

In Table 26, the test statistics of the Wilcoxon signed ranks test for BSCI-Y T-score at T1 and T3 show that the estimated p value of the two-tailed hypothesis equals to p = 0.091. Thus, it can be concluded that there was no statistical significant difference between the level of self-concept measured by the BSCI-Y test at T1 and T3 (z = 1.690, N – Ties = 11, p = 0.091, two-tailed).

6.2.3 Sexual behaviour problems

Below, a table of the applied CBCL Sex Problems Scale is presented (Table 27). The table includes the five items and the respective sum-score assessed at T1 and T3. The sum-score indicates both the number of parents who have reported a problem and the graduation of the problem (0-2 point Likert scale) in relation to the specific item. Only 13 out of 16 parents completed the CBCL questionnaire both at T1 and T3. The reason for the missing three parent-reported questionnaires is one drop-out and two participants who are currently following the program and will not complete their T3 assessments before October this year. Thus, the maximum possible score for each item is 26.
Table 27: CBCL Sex Problems Items at T1 & T3

<table>
<thead>
<tr>
<th>Item Description</th>
<th>T1 (sum-score)</th>
<th>T3 (sum-score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Plays with own sex parts in public</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2 Plays with own sex parts too much</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3 Sexual problems</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>4 Thinks about sex too much</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>5 Wishes to be of opposite sex</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

First, the parents were asked if their children play with own sex parts in public. To this item, the sum-score was two at T1 and zero at T3. Second, the parents were asked to report if their children play with own sex parts in public. At T1 the sum-score to this question was four, whereas no such problem was reported at T3. Third, the parents were asked to report sexual problems, to which the sum-score equals four, and zero at T3. Fourth, the parents reported if they perceive their children to think about sex too much. To this item, the sum-score was five at T1 and two at T3. Finally, the parents reported if their children wish to be of the opposite sex. According to the estimates in this study, no such problem was reported at neither T1 nor T3.

In accordance to the indicated sum-scores, H₀ is rejected and Hₐ is accepted, suggesting a negative difference in the sexual behaviour problems measured by sum-scores for each item in the CBCL Sex Problem scale in all TTT participants at T1 and T3.

6.3 Some thoughts on multiple testing

Some might object and state that the possibility of a Type 1 error is inflated because a search for differences between means, caused by the training, is conducted four times (a difference in means caused by training is investigated with two tests (the PKT and the BSCI-Y test) on two occasions (when comparing T1 and T2 and T1 and T3). This gives four times where the same hypothesis is tested on the same group (when comparing T2 and T3 the hypothesis is not that the training cause a difference since there is no training between T2 and T3 so the three comparisons made here does not inflate the risk of the Type 1 error of concluding that the training helped). Therefore, there could be a problem with multiple testing. It is actually possible to argue that as long as the two tests answer different questions, which they do in one sense (psychosexual knowledge and self-concept), then they are independent in terms of any final conclusion because there would be two different
conclusions: about psychosexual knowledge and self-concept. If, for example, both tests measured self-concept then there would certainly be a problem because then the Type 1 error for detecting changes in self-concept would increase. In another sense, though, both tests ask whether training caused a difference so it is fairer to speak of six times testing the same hypothesis.

When correcting for multiple testing one often uses the Bonferroni correction. The Bonferroni correction is also called the unweighted Bonferroni method because it is done in one step (i.e. \( \alpha/n \), where \( \alpha = 0.05 \) and \( n = \) number of times the hypothesis is tested which is 4 in the current study). The consequence of using the unweighted Bonferroni procedure is that the larger the number of hypotheses tested the smaller the average power for testing the individual hypotheses (which means increasing the risk of a Type 2 error, also something one must try to avoid). One can (partly) avoid this risk by using Holm's sequentially-rejective Bonferroni method (Shaffer 1995). This method is applied in stages as follows in the table below (Table 28) where the four p-values are ordered from smallest to largest and compared to the adjustment of alpha according to Holm's sequentially-rejective Bonferroni method.

Table 28: Holm's sequentially-rejective Bonferroni method

<table>
<thead>
<tr>
<th></th>
<th>( \leq 0.05 ) / (4-k+1)</th>
<th>( T )</th>
<th>Test</th>
<th>Sig. (0.05 level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PKT</td>
<td>0.01 ≥ 0.05 / (4-2+1) = 0.017</td>
<td>T1/T3</td>
<td>t-test</td>
<td>\text{Sig. (0.05 level)}</td>
</tr>
<tr>
<td>PKT</td>
<td>0.01 ≤ 0.05 / (4-1+1) = 0.0125</td>
<td>T1/T3</td>
<td>t-test</td>
<td>\text{Sig. (0.05 level)}</td>
</tr>
<tr>
<td>BSCI-Y</td>
<td>0.01 ≤ 0.05 / (4-3+1) = 0.025</td>
<td>T1/T2</td>
<td>Wilcoxon</td>
<td>\text{Sig. (0.05 level)}</td>
</tr>
<tr>
<td>BSCI-Y</td>
<td>0.091 ≥ 0.05 / (4-4+1) = 0.05</td>
<td>T1/T3</td>
<td>Wilcoxon</td>
<td>\text{Not sig. (0.05 level)}</td>
</tr>
</tbody>
</table>

As can be seen this procedure does not change the conclusions that can be drawn, based on the significance tests being performed in the current study, without any correction for multiple testing.

7.0 Discussion

In this chapter, the following topics will be discussed: statement of principal findings, strengths and weaknesses of the study, strengths and weaknesses in relation to other studies, meaning of the sexual behaviour findings and suggestions for future research.
7.1. Statement of principle findings

This study did not find evidence for any negative effects of the TTT program on the psychosexual functioning in 12-17 years-old adolescents without offensive sexual behaviour, of average or above average intelligence and with ASD in a Danish context. This is a very important finding since it is quite reasonable to assume that an increased focus on sexuality, in this particular sample, could have negative side effects on self-concept or sexual behaviour.

First, the study found a strong primary outcome effect, which validates the TTT intervention program. Thus, the study found a statistical significant increased level of psychosexual knowledge from T1 (M = 21.2, SD = 8.8) to T2 (M = 30.4, SD = 4.1, p = 0.001, two-tailed), and from T1 to T3 (M = 31.2, SD = 3.9, p < 0.0005, two-tailed), but not from T2 to T3. Second, it is concluded from the findings, that the secondary outcome level of positive self-concept statistically significantly increased in the participants from T1 (M = 44.0, SD = 8.2) to T2 (M = 50.3, SD = 8.8, p = 0.010, two-tailed) but not from T2 and T3, and T1 and T3. Third, findings from this study, indicate that the level of problems with sexual behaviour in participants decreased from T1 to T3.

7.2 Strengths and weaknesses of the study

This chapter includes a discussion of the strengths of the TTT intervention program, study design, and data set, as well as weaknesses in relation to sample size, study design and internal validity.

7.2.1. Strengths

First, one major strength of the TTT intervention program assessed in this study, is that it consisted of 18 individual sessions at about one hour of training each. During these sessions, a holistic approach was used, and important subjects related to sexual behaviour, sexual selfhood and sexual socialization were addressed in depth by use of a structured and repetitive workbook. Moreover, the applied workbook included visually presented information as well as concrete definitions of concepts. These characteristics of the TTT materials are all strongly supported by current literature (Ray et al. 2004; Beddows & Brooks 2015).

Second, the TTT program provided training by skilled personal, who participated in train-the-trainer master-classes prior to the enrolment of the training program This might have made the trainers well equipped for tailoring the training to the individual needs of the participant. Moreover,
the trainers received supervision during the training period, which might have helped the trainer in handling difficulties during the training sessions.

Third, a strength of the study design is the process evaluation made during the enrolment of the TTT program, which made it possible for the trainers to report any difficulties faced in following the research protocol, workbook or teaching manual. This made it possible to share experiences and make general adjustments to the program in order to improve the outcome. For instance, the non-response rate in this study from baseline to post-training assessment was 10 percent due to refusal to corporate. Based on experiences from the trainers, adjustments to the PKT material were made to ensure better corporation with the participants, which might have resulted in more responses from sensitive adolescents. Thus, the findings on the primary outcome variable might be easier to generalise to a more diverse group of adolescents with ASD.

Fourth a strength of the pre- and post-training design incorporated in a care-as-usual setting, is that outcome measures were assessed both at baseline, post-training and six months’ follow-up. Thereby, it was possible to assess whether the outcome variables did change over time. Especially, the six months’ follow-up assessment make strengths to the assumptions about stability of the measured effects of the TTT program on psychosexual knowledge.

Fifth, a strength of the data set applied in this study, is the high-quality golden standard diagnostic instruments (ADOS-2 and ADI-R) and effective screening instruments (RIAS and SRS), which were assessed in the participants prior to the intervention by skilled psychologists. The total collection of these data is costly, but ensures that the participants included in the study matches the TTT intervention material, which is tailored to the special needs of adolescents with ASD at average or above average intelligence level.

7.2.2. Weaknesses
The current study has some limitations, which warrant caution with interpretation and generalization of the preliminary study findings. First, this pilot study had a relatively small sample size and only few clusters was used in the sampling. Thus, the study might be affected by allocation bias and sample has a low representativeness of the total study population. Due to the low representativeness of the sample, it is not possible to generalise the findings to the entire group of
12-17 years old adolescents with ASD living in Denmark. In relation, the sample only included few girls (n = 5), which makes it even more questionable to generalize the findings to adolescent females. Despite the reduced external validity of this study, the small sample size and number of clusters might have increased the internal validity as it made it more feasible for the project manager to control for performance bias by ensuring protocol adherence.

Another limitation of this study was to study volunteers only, which might have caused that the participating adolescents was more motivated to receive psychosexual education than average adolescents with ASD. This might have influenced the results of this study as the participants might differ from the total study population. For instance, the participants might be more focused and active during the TTT sessions, and thereby gaining more knowledge and skills throughout the program. This bias might positively affect the measured outcomes of this study, i.e. increasing the level of psychosexual knowledge and improving the level of self-concept, as well as decreasing the level of sexual behaviour problems in the participants. Nevertheless, even though the participants recruited at CFA was volunteering, two participants dropped out of the program after 3-4 sessions due to lack of motivation of the adolescents. This indicate that the volunteering bias might not have affected the results to a large extend.

In addition, it is a limitation of the study, that the quality of the applied psychosexual knowledge test (translated version of the Dutch knowledge test used by Visser et al., 2017) was considered as low. It had not been developed in collaboration with a clinical sexologist, back-forward translated/following the EORTC guidelines, modified to a Danish context or pilot tested prior to the assessments. Moreover, the knowledge test was used in same version at both pre- and post-assessments. Consequently, it is possible that the increase in psychosexual knowledge is caused by adolescents who have sought out information specifically related to a specific question after the baseline assessment (e.g. by discussing the question with their parents and get corrected). This might be true, even though the questionnaire was handed in and kept by the trainer out of reach for the adolescent to revise it. Thus, some adolescent might have been prepared with a larger number of right answers to the questions in the PKT at T2 and T3, without any impact of the TTT program. In addition, it is quite reasonable that the participants have received some sort of sexual education during the time period in which they followed the TTT intervention. These possible biases are the
reason why the results of the primary outcome cannot be assigned absolutely to the TTT program and the internal validity of the study is reduced.

In sum, due to the low sample size and the sampling method there is a theoretical possibility for the participants chosen not being representative for the population they represent and for sampling bias in this study. Nevertheless, all participants in the sample met the inclusion criteria (measured using highly recognised psychological tests) and as such it can be argued that the characteristics of the participants in the sample were highly representative of the study population. But, of course, great care must be taken not to draw conclusions or make recommendations that are not justified due to the usual possible problems imposed on so many studies (i.e. low sample size and sampling method).

7.3 Strengths and weaknesses in relation to other studies

First of all, the findings of the current study support results in the pilot study by Dekker et al. (2015), Escalona et al. (2016) and Visser et al. (2017) on the effect of the TTT program on psychosexual knowledge in adolescents with ASD (11-19 years-old) in the Netherlands. In the study by Dekker et al. (2015) the primary cognitive outcome showed a significantly increased psychosexual knowledge from pre-training (M = 25.80, SD = 6.30) to post-training (M = 33.80, SD = 2.72, p < 0.001) (Dekker et al. 2015). In comparison, this study showed slightly lower mean scores in the psychosexual knowledge test from pre-training (M = 21.2, SD = 8.8) to post-training (M = 30.4, SD = 4.1, p = 0.001). Thus, the TTT program seem to be effective on psychosexual knowledge in both Dutch, Spanish and Danish adolescents with ASD.

In relation, findings in this study on correlation between specific age and change in psychosexual knowledge from baseline to post-training assessment, shows that there was no statistical significant correlation (neither positive or negative) (r = -.224, n = 16, p = 0.405, two-tailed). Thus, the current study does not support the findings on positive correlation between age of the adolescent and psychosexual knowledge by Winn et al. 1995, Dekker et al. 2015, Escalona et al. 2016 and most recently, Visser et al. 2017.

Moreover, the RCT testing the effect of the TTT program by Visser et al. (2017) showed a decrease in the reported sexual behaviour from baseline to post TTT-training in all adolescents with ASD.
This finding is supported by the current study in which sexual behaviour measured by CBCL Sex Problem Scale suggests a negative difference in the sexual behaviour problems measured in all adolescent with ASD from baseline to six months’ follow-up assessment.

7.4 Meaning of the findings on sexual behaviour problems

In general, findings of this study show a tendency of decrease in sexual problems measured by the CBCL Sex Problem Scale. As we knew from the recruitment of participants for this study, the sample did not have severe sexual problems at baseline. This is evident as the sum score for each item is quite low, indicated by a maximum-score in this study that equals to 5 out of a maximum score at 26. Despite the floor-effect of low sum-scores, it is still possible to see a decrease in the sum-score of sex problems. Therefore, it is a finding that only very few parents reported sexual problems at baseline, but also at six months after their children participated in the TTT program. In relation, this study indicates that adolescents with ASD, even with a low score at T1, will decrease their sexual problems from T1 to T3.

7.5 Suggestions for future research

This pilot study provides information, which prepares a randomized controlled trail, testing the effect of the TTT program on a lager sample size including a more comprehensive amount of measures on everyday psychosexual functioning i.e. sexual behaviour, sexual selfhood and sexual socialization. For instance, it is suggested to include the comprehensive questionnaire TTI to make parent- and self-reported assessments of all three domains of psychosexual functioning in adolescents with ASD. In addition, it is recommended to include individual characteristics i.e. gender, intelligence and ASD in main analyses, as it may influence the effect of the training program. This was not possible in this pilot study, which did not have sufficient power due to the small sample size.

Moreover, it is suggested to use two control groups; a waiting list control group receiving and a TD control group. In the waiting list control group, a comparable group of adolescents with ASD and their parents would undergo the same training program as the intervention group, but be sorted on a waiting list for receiving the training at a later point. These findings would add more knowledge on the actual effect of the TTT program on the psychosexual functioning in adolescents with ASD in a Danish context. Moreover, the use of a TD control group including comparable adolescents and
their parents, would make it possible to directly compare the groups in their psychosexual knowledge. Thereby, it would be possible to assess if the level of psychosexual knowledge in the TTT participants exceeds the level of psychosexual knowledge in TD peers, as a consequence of the TTT intervention program.

In this study, there were signs that the secondary outcomes i.e. level of positive self-concept and sexual behaviour problems improved from baseline to post-treatment assessments. In terms of the secondary outcomes a control group would have strengthened the results since sexual behaviour problems can be thought to improve with age (Letourneau et al. 2004; Visser et al. 2017), whereas self-concept might decrease with age (Vickerstaff et al. 2007).

Moreover, it is suggested to use both parent-report and self-report assessments at all outcome variables, in order to get both perspectives on several aspects of psychosexual functioning of the adolescents. The need for this, is that it is likely that parents and adolescents themselves do not perceive their psychosexual functioning completely the same, particularly in the domain of sexual behaviour (e.g. sex behaviour problems) and in the domain psychosexual selfhood (i.e. self-concept). Recent literature indicate that parents of adolescents with ASD reported significantly more problems with sex behaviour than the parents of the TD adolescents, while self-reports did not show significant differences. A likely explanation for this, is that parents’ pathologies the behaviours of their children more, and/or the child has less self-reflection decreasing the reliability of their self-report. Moreover, it is suggested to make adjustments to the psychosexual knowledge test in order to increase the internal and external validity of related findings.

8.0 Conclusion and global health perspectives

This Danish pilot study contribute to the growing evidence promoting training in psychosexual topics of adolescents with ASD. It seems quite reasonable to conclude that the effect of the Tackling Teenage Training program in 12-17 years-old adolescents with ASD in a Danish context, is increased level of psychosexual knowledge, increased level of positive self-concept and decreased level of sexual behaviour problems. That is reasonable, even without a control group. Based on the findings of this study, the TTT intervention program might be an important first step towards reducing the risk of vulnerability with ASD in a Danish context.
Current evidence introduced in this study indicate, that the short-term (T2) and long-term (T3) effect on psychosexual knowledge post TTT training found in this study, may decrease the risk of becoming a victim of sexual coercion, sexual bullying, or sexual abuse. This is why this subject is a highly relevant in a global context. It is plausible to suggest that results and experiences from TTT program in The Netherlands, Spain and Denmark indicate that the TTT program under certain conditions can be relevant to use in other parts of the world too. Though, some possible challenges can be discussed when generalising Dutch and Danish experiences with TTT to a global context.

Evidence show, that most research into the epidemiology, diagnosis and treatment of autism is based on studies conducted in high income countries. Moreover, within high-income countries, participants in autism research are overrepresented by individuals of high socioeconomic. Globally, the inequality especially relates to access to autism screening, diagnosis, and therapy. Barriers that keep this imbalance going, is the high cost of golden standard diagnostic tools for autism, training of professionals to use the tools, and provision of evidence-based treatment. These factors might make it challenging to generalising the TTT intervention program to a global context. Though, a recent study by Durkin et al. 2015, supports that open access to scientific articles on psychosexual education for adolescents with ASD, might be a way to facilitate global collaboration and training, and to create a united and efficient autism scientific community for scientists and clinicians worldwide, in order to improve the conditions of adolescents with ASD in the future.
9.0 References


Durkin, M.S. et al., 2015. Autism Screening and Diagnosis in Low Resource Settings: Challenges


IBM United States Software Announcement 213-309, 2013. IBM SPSS Statistics V22.0.


Joseph, L. et al., 2016. *Autismspektrumfostyrrelse*, Hogrefe Psykologisk Forlag. Available at:


Palinkas, L.A. et al., 2015. Purposeful Sampling for Qualitative Data Collection and Analysis in


Undervisnings Ministeriet, 2016. Grundskolen Karaktergennemsnit i bundne prøvefag - Grundskolen - Uddannelsesstatistik. Available at: https://www.uddannelsesstatistik.dk/grundskolen/karakterer?authToken=eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCJ9.eyJhdWQiOiJ1cm46QXBwbGlja1w6bGVnYnkiLCJpZCI6IiIsImV4cCI6MTQ4NTA3OTMyNCwiZ19pIjoxfQ.eyJzdWIiOiJzdW1iX2Nvb2tlbl90b2tlbiIsImV4cCI6MTU0OTgwNTkwOCwiaGVpIjoicm9sZi50ZXh0LmNvdXJjZV9hZGZzL3Nlc3NhZGV2ZiIsImlzIl0sImV4cCI6MTU0OTgwNTkwOCwiZXhwIjoxMDQ4NTk5OTM5fQ.uwBxh8IjRZ9VQ-4vPEEM98eSWePSsWAYvJ2IeSSr0oI [Accessed August 7, 2017].


