Was everything much better before?

A comparison of children's gross motor skills in 1995, 2004 and 2018

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Foreword

My years as a master's student at University of Agder are coming towards the end. I have never learned as much as during this period as a student. The process with this master's thesis has sometimes been demanding alongside a full-time job as a teacher, but above all, it has been very interesting and educational. My interest in sports and performance development in sports has grown throughout my years as a student. The correlation of motor skills with sports made me think about researching the development of motor skills in children over time. I wanted to see if there was a decline in motor competence of children now compared to before. That led to this study being a continuation of previous research carried out by Kari Christiansen. Hopefully, this master thesis can contribute to information about the development of children's motor skills over time. I also hope that my work can create curiosity for further research in this area.

My master thesis has finally been completed, but not without great help from my wonderful supervisor, Tommy Haugen. First, I would like to thank you for your honest, clear, and constructive feedback. Your helpfulness, understanding, and great knowledge have been central to me in the process of completing my master's thesis over the past few years. Thank you so much for the great cooperation! I would also like to thank my other supervisor, Aron Gauti Laxdal. Thank you for your tips and the fast and great feedback. You have been very helpful in the final stages of this project. I thank Kari Christiansen for her previous research which made it possible for me to carry out this study.

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I would like to thank all participants, parents, teachers, and schools who made it possible to carry out this study. Thanks to all of you for your contribution! Finally, I would like to thank the University of Agder, and all the lecturers who have contributed with great professional expertise.

Sammendrag

Bakgrunn: Denne studien var en videreføring av tidligere forskning som ble utført i 1995 og 2004 for å kartlegge forskjeller i grovmotorikk i sju- og åtteåringer. Det hevdes at velutviklede grovmotoriske ferdigheter bidrar på en positiv måte til aktiviteter gjennom livet og fører til vekst av mer kompliserte motoriske og sportsspesifikke ferdigheter.

Hensikt: Målet med denne forskningen var å finne ut om det har vært en nedgang i grovmotorikk blant sju- og åtteåringer de siste tiårene i Nøtterøy og kartlegge forskjellene.

Metode: Det var 45 deltagere i alderen syv og åtte år. I denne studien var 24 av deltagerne jenter og 21 var gutter. Deres motoriske kompetanse ble målt med Körperkoordiationstest für Kinder og analysert før sammenligning med data fra 1995 og 2004.

Resultater: Resultatene fra testene i 2018 ble sammenlignet med resultatene fra 1995 og 2004. Det ble sett en signifikant nedgang i den totale motoriske kvotienten til deltagergruppen. Det var en nedgang på 14.3 poeng fra 1995 til 2018 og en nedgang på 16,4 poeng fra 2004 til 2018. Begge kjønnene scoret signifikant lavere i 2018 sammenlignet med 1995 og 2004. Jentene skåret litt bedre enn guttene med .9 poeng høyere i total motorisk kvotienten i 2018.

Konklusjon: Det finnes en nedgang i grovmotorikken blant sju- og åtteåringer i Nøtterøy i 2018 sammenlignet med 1995 og 2004. Fremtidig forskning bør se mer på hvilke faktorer som påvirker motorisk kompetanse mest, og se videre på sammenhengen mellom disse og motorisk utvikling og fysisk aktivitetsnivå.

Nøkkelord: Fysisk aktivitet, Körperkoordiationstest für Kinder, motoriske ferdigheter, motorisk kompetanse, motorisk utvikling.

Abstract

Background: This study was a continuation of previous research that was carried out in 1995 and 2004 to map differences in gross motor skills in seven- and eight-year-olds. It is claimed that well-developed gross motor skills contribute in a positive way to activities throughout life and lead to the growth of more complicated motor and sport-specific skills.

Purpose: The aim of this research was to find out whether there has been a decline in gross motor skills among seven- and eight-year-olds in recent decades in Nøtterøy and to map the differences.

Method: There were 45 participants aged seven and eight. In this study, 24 of the participants were girls, and 21 were boys. Their motor competence was measured by the Körperkoordiationstest für Kinder and analyzed before comparison with data from 1995 and 2004.

Results: The results from the tests in 2018 were compared with the results from 1995 and 2004. A significant decrease was seen in the total motor quotient of the participant group. There was a decrease of 14.3 points from 1995 to 2018 and a decrease of 16,4 points from 2004 to 2018. Both genders scored significantly lower in 2018 compared to 1995 and 2004. Girls scored slightly better than the boys by .9 points higher in total motor quotient in 2018.

Conclusion: There is a decline in gross motor skills among seven- and eight-year old's in Nøtterøy in 2018 compared to 1995 and 2004. Future research should look more into which factors influence motor competence the most and look further into the connection between factors and motor development and physical activity levels.

Key words: Körperkoordiationstest für Kinder, motor competence, motor development, motor skills, physical activity.

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1.0 Introduction

The ability to perform various motor skills such as running, kicking, jumping, throwing in an efficient manner, is often defined as motor competence (Goodway et al., 2019; Haga et al., 2008). Studies (Hardy et al., 2013; Okely et al., 2004; Tester et al., 2014; Vandorpe et al., 2011) have found decreased levels of motor competence during the past few decades in primary school children in western countries. Finding like these are of major concern. Research (Lubans et al., 2010) shows that children with high motor competence have positive outcomes in physical activity and weight status. Findings in some studies (Barnett, Van Beurden, Morgan, Brooks, Beard, et al., 2008; Jaakkola et al., 2016; Lopes et al., 2011) show that motor competence predicts levels of physical activity and physical fitness in later life.

The topic regarding today's children's motor skills is frequently discussed in Norway. There is often talk about this in the media, that children today watch more tv, they play videogames and regularly spend their time on tablets and computers. These are suggested as some of the causes for a decline in motor competence. According to Christiansen and Hagen (2005) the media "(Aftenposten, 2005)" has been stating that children's endurance, strength, and motor skills have been declining compared to previous years. At the same time there has been an increase in the time spent on TV, computers, videogames and other activities that do not require physical movement (Samdal et al., 2009) . Parents and teachers are encouraged to work together to motivate the children to be more physically active (Shen et al., 2018). This can be achieved by promoting the schoolyard and the nearby areas where they live with more play structure (Schmidt, 2004). Today's young children are being raised in a digital environment. They are living in an environment where access to television, computers, social media and smartphones is approximately limitless (Tømte & Søby, 2009). Therefore, the schoolyard and nearby areas play a very meaningful part in children's approach in physical activities. In addition to the nearby areas the woods play a much important part as well. These kind of areas give children much different motor skill challenges than the asphalt (Fjørtoft, 2000).

Adequate coordination level is required (Vandorpe et al., 2011) along with mastery of fundamental motor skills for daily functioning (Goodway et al., 2019; Henderson & Sugden, 1992a). Playing with friends, doing social activities, doing basic locomotor activities such as crawling, walking and running require a fundament of motor skills (Haga, 2008; Ommundsen

et al., 2010). A study from 2000 (Bjelland & Klepp, 2000) found that the activity levels of schoolchildren in Norway had decreased compared to previous years. Since motor skills are an underlying factor that promote engagement and attendance in physical activities (Stodden et al., 2008a), it is important for one's physical form. Research tells us that kids with greater control over their motor skills are more likely to have better physical form as young adults (Barnett, Van Beurden, Morgan, Brooks & Beard, 2008). Good motor skills are important as they represent a large part of the youth's general education (Utdanningsdirektoratet, 2020). It is an important foundation for their health, function and cultural participation, both in school and in life in general (Ommundsen, 2008).

There has been a steady uptick in concerns related to declining motor skills and physical activity in children as mentioned earlier. Motor competence (the ability to perform skilled motor behavior) should be developed during childhood (Goodway et al., 2019). Some level of motor competence is important to have to get through a day filled with tasks that challenge a person's practical skills. Difficulties with motor development have crucial connection with various aspects in the daily life of children (Piek et al., 2006). The likelihood of participation in physical activities is significantly impacted by impaired coordination (Smyth & Anderson, 2000). Motor competence significantly impacts overall performance on different physical fitness components (Cairney et al., 2007; Hands, 2008; Hands & Larkin, 2006).

A child's motor competence can often be seen when one starts in school. For normal motor development in early school-aged children it's important that they have acquired fundamental movement skills that allow them to do daily tasks and participate in a variety of physical activities (Fisher et al., 2005; Mukherjee et al., 2017; Olrich & Dance, 2002). How well a child meets the expectations of skills required to participate in daily tasks or games is all determined by one underlying factor – Motor competence. If one struggles with these skills and activities, it might be an indication that the child has developmental coordination disorder (DCD) (Zwicker et al., 2012). DCD is heterogeneous, with some children having difficulties with both fine and gross motor skills or only one of them (Visser, 2003).

Previous research has shown that motor competence plays a part in children's mental health (Moser & Berggraf Jacobsen, 2002). Poor physical self-perception, reduced motivation to participate in physical activity, less contact with age peers, and consequently fewer opportunities to develop proficient motor skills and adequate fitness levels can all be

consequences of long-term low motor competence (Cantell & Crawford, 2008). A child's popularity and social status can often be determined by the skills displayed in games and activities and by one's physical activity levels (Ommundsen et al., 2010). Possessing the skills required to succeed in an activity or game then increases the child's confidence (Schoemaker & Kalverboer, 1994). If one does not have the skills necessary to succeed, then that can result in the individual child experiencing having lower status in the eyes of others and having low confidence. The danger in one child not experiencing success, and having low confidence is that they can shy away for activities and games with other children (Henderson, 1992). This results in them not getting the same experiences with movement that other children get, which exacerbates the problem. Problems with performing and mastering many basic movement skills essential for full participation in game, sports and other recreational activities are consequences of reduced or low motor competence in children. This could potentially lead to reduced physical fitness in one's life (Hands & Larkin, 2006).

Physical fitness is defined by Caspersen et al. (1985) as a set of attributes that people have or achieve that relate to the ability to perform physical activity. Physical fitness is considered "a powerful marker of health" in childhood (Ortega et al., 2008). Various components such as cardiovascular endurance, muscular strength, flexibility, and motor control make physical fitness a multidimensional construct (Vanhees et al., 2005). An unfavorable interaction between low motor competence and physical fitness is found to start at an early age (Hands & Larkin, 2006). Children with poor coordination and poor motor competence are less physically active (Castelli & Valley, 2007; Lopes et al., 2011) and less fit (Hands & Larkin, 2006; Wrotniak et al., 2006) compared to their peers in school (Haugen & Johansen, 2018).

It's important for our research to catch if a decline in motor competence among seven and eight-year-olds over time exists. If so, it can have long term consequences for physical fitness and mental health among a variety of other things. Even though some studies (Hardy et al., 2013; Okely et al., 2004; Tester et al., 2014; Vandorpe et al., 2011) have shown a decline in motor competence, we don't know enough about whether children have become less motorically competent over time. The aim of this study is to evaluate the motor competence of seven and eight-year-olds from Nøtterøy in Norway in 2018 using the Körperkoordiationstest für Kinder (KTK) and compare them with previous findings from the same geographical area to identify any decline in motor competence.

1.1 Aim of the present study

Previous research (Christiansen & Hagen, 2005, 2006) measured and tested the motor competence of seven- and eight-year-old children in 1995 from Nøtterøy in Norway. The same procedure was repeated in 2004, with a new cohort of the same age from the same town, to see if any differences in gross motor skills had occurred. That way the publications addressed the question "Are there any differences in motor competence among seven- and eight-year-old children in Nøtterøy from 1995 and 2004?". Christiansen and Hagen (2005) study revealed no significant changes in the motor competence from 1995 to 2004. 14 years later, the present study aims to compare the seven- and eight-year-olds living in Nøtterøy in 2018 to the ones who were tested previously. By repeating the same procedure, the intention is to answer the question "Are there any differences in motor competence among seven- and eight-year-olds in Nøtterøy from 1995 and 2004 to 2018?". The hypothesis of this study is that there will be a decline from 1995 and 2004 to 2018.

2.0 Theory

Motor skills is a central concept in research and practice when it applies to physical education and sports, and can be understood as the opportunity to repeatedly try and achieve a goal through learned movement of one or several body parts (Goodway et al., 2019). When control over movements of the joints and body is a must-have to achieve an objective in activities or tasks, that is called motor skills (Magill & Anderson, 2010). In other words, motor skills are seen as skills that require achieving some explicit natural objective by maximizing the accomplishment certainty and the physical and mental energy costs of performance, and reducing the time (Schmidt & Wrisberg, 2008).

Motor learning understandably is about generating more efficient movements (Krakauer et al., 2019). Motor learning is an absolute term that embodies a wide range of phenomena, approaches, and discipline (Krakauer et al., 2019). It applies to mechanisms of a body and movements made by approximately any living species. Physical therapists, dancers, athletes, sports coaches, and trainers are few of many that see motor learning's practical importance in their day-to-day work. Motor development is connected to the concept of motor learning. Motor development is extended change in motor behavior throughout one's life, which occurs by a cooperation between the demands of the movement task, the individuals biology, and the surroundings (Goodway et al., 2019). This understanding of motor development is in line with the most used theories about motor skills, and an important point in the definition is that it is considered a lifelong process (Holder, 2008; Utley, 2018). When we talk about motor skills, motor learning and motor development the term motor competence is regularly brought up. The ability to perform various motor skills is often defined as motor competence (Goodway et al., 2019; Haga et al., 2008).

Motor competence is mandatory for a person to function and master practical skills in one's everyday life. When children start going to the school it becomes clearer if they can master a skill or not, skills like getting dressed, holding a pencil, writing, and drawing are some examples on skills that are expected of them. It is also expected that they can participate in play and other activities at the school, such as cycling or ice-skating. If a child at the school age has difficulties with daily tasks and gross motor activities, it reduces the child's participation (Summers et al., 2008). To which degree the child functions satisfactorily towards the daily tasks and requirements has a big influence from the motor skills (Christiansen & Hagen, 2006).

Having a wide motor competence is important for performing daily tasks, but it is also important in relation to children's mental health (Moser & Berggraf Jacobsen, 2002). Children's cognitive development is thought to be made easier if one has well-developed gross motor skills (Piek et al., 2008; Son & Meisels, 2006; Westendorp et al., 2011). A child's skills in plays and sport are related to popularity and status among other children, one's confidence is built by succeeding in these (Christiansen & Hagen, 2006). Children with low or bad motor skills will experience low status in other children's eyes and they will not be among the popular ones, they will also experience having low confidence (Schoemaker & Kalverboer, 1994). The danger when children with low motoric competence avoid playing with other children is that they lose valuable time spent in gaining movement experience, that results in them being left behind in motor development (Henderson, 1992).

Another thing that is important to note when children do not participate in playing with others is that they limit their own social interactions with the other children. Having low and less developed motor skills can bring negative consequences. This can have a significant impact on the child's life (Christiansen & Hagen, 2006). Fitness level and general health are impacted by motor competence, and it plays an important role in both (Blair et al., 2001; Cantell & Crawford, 2008; Lubans et al., 2010).

In physical activity the motor competence is considered an important underlying factor (Stodden et al., 2008b; Utesch et al., 2019) and these two are shown through research to have a positive relationship in youth (Holfelder et al., 2014; Logan et al., 2015; Lubans et al., 2010; Utesch et al., 2019). Absence of physical activity is considered to be a genuine health problem globally (Guthold et al., 2018). Crucial time for development of fundamental movement skills is early childhood as they are considered building blocks that generate particular movement sequences required for sufficient participation in organized and non-organized physical activities through the lifespan (Clark et al., 2002; Goodway et al., 2019; Lubans et al., 2010).

Fundamental movement skills are considered a core factor in the promoting lifelong active lifestyle and health (Clark, 2005; Lubans et al., 2010; Robinson et al., 2015; Stodden et al., 2008b; Strong et al., 2005). In literature, fundamental movement skills are classified into three constructs, locomotor skills, object control/manipulative skills and stability/non-locomotor skills (Goodway et al., 2019).

Physical activity levels later in life are affected by motor competence levels during childhood (Barnett, Van Beurden, Morgan, Brooks, Beard, et al., 2008; Lopes et al., 2011). Gross motor skills especially play an important part in growth, development, and opportunities that lead to physically active lifestyle (Lubans et al., 2010; Robinson et al., 2015; Stodden et al., 2008b).

Children having complications with a range of gross motor skills are often associated with terms as clumsy or motor impaired, and as children with DCD (developmental coordination disorder) (Mathisen, 2016). These children regularly disengage or are shut out of play with other children and are displayed to be less physical active compared to other peers (Geuze et al., 2001; Mathisen, 2016; Wrotniak et al., 2006). Motor development is stimulated by activity, and it is diminished by insufficient activity (Cantell & Crawford, 2008; Fisher et al., 2005). This goes back to that participation in activities require a set of motor skills and the importance of motor skills.

Well-developed gross motor skills contribute in a positive way towards ones activities of daily living (Watkinson et al., 2001). It is also considered that well-developed motor skills can be seen as building blocks for the growth of more complicated motor and sport-specific skills (Stodden et al., 2008a; Wall, 2004). Research shows (Westendorp et al., 2011) that the involvement of gross motor skills can be seen in many physical activities and are essential in performing sport-specific skills (Barnett et al., 2009; Graf et al., 2004; Okely et al., 2001; Wrotniak et al., 2006). In some studies, it is shown that there is a positive relationship between gross motor skills and organized sports participation (Barnett et al., 2009; Okely et al., 2001; Ulrich & Sport, 1987).

It is challenging to promote physical activity across the lifespan, but research supports that a positive relationship between motor competence and physical fitness from early childhood and with increasing age exists (Utesch et al., 2019). Primary school children are in focus in the present study. During school the population can be reached and helped in a wide range of areas at an early phase. Early support can be provided, and a range of future problems may be prevented. Furthermore, participation in sports may be increased by encouraging growth in motor competence and well-developed motor skills.

Roth et al. (2010) aimed to find if there was a secular decline in motor skills in preschool children. 726 preschool children from 2007 were tested with focus on weight, height, and

motor performance changes. The results were compared to historical data from 1973, 1985 and 1989. Roth et al. (2010) found no universal decline in the motor skills. There were findings on significant improvement and significant decline in some tasks. Roth et al. (2010) found a secular decline in some, but not all motor skills, and says that may indicate a change in behavior.

Tester et al. (2014) aimed to provide normative data for primary-school children, to identify secular trends in data over three decades. Data for children's physical, fitness and skill quotient were collected over a period of 30 years (1981-2012). Tester et al. (2014) found a decline in skills level for young children was identified. Fitness levels were maintained, but skills decreased especially in females over the past two decades prior to 2012.

Vandorpe et al. (2011) evaluated the suitability of KTK as an assessment instrument for gross motor coordination in 2470 children from 26 elementary schools for general education spread over the Flemish and Brussels-capital region. Findings showed that overall, the participants scored significantly worse than participants from 1974. 21 % of the participants were placed in the problematic range. There was a decline in tasks relying on coordinative capacities, but improvements were found in tasks relying on strength and speed.

Koeppel et al. (2022) researched trends in gross body coordination and cardiorespiratory fitness in 35000 second graders. A general decline in was confirmed for coordinative abilities.

Martins et al. (2010) measured levels of motor coordination with the KTK test battery as part of a study that researched om BMI in 285 children. Participants were enrolled in the first grade and followed through fifth grade. Gross motor skills were negatively associated with BMI-changes. No gender-specific associations were found.

2.1 Factors that affect motor skills and motoric competence

2.1.1 Family socioeconomic status

Previous studies (Venetsanou & Kambas, 2010) show a relation between a child's motor development and their socioeconomic status. A family environment where children can participate in activities contributes to the motor development of children. A study form early 2000's (Lejarraga et al., 2002) indicated that the social class and educational level of the mother was related to the psychomotor performance in children over 1 year of age. The same study noted that the better scores in developmental tests of low social class was caused by

indigenous child-upbringing practices. These practices were nursing and close contact between mother and baby, these practices had a positive influence on development.

Relevant studies suggest that lower social class children score worse that the children from middle or high social class in motor development assessment batteries (Bax & Whitmore, 1987; Camp et al., 1977; Giagazoglou et al., 2005; Krombholz, 1997; Larsson et al., 1994). This can be understood by looking at several different explanations given:

- Perceptual-motor problems could be related to the central nervous system being badly affected by poor pre- and post-natal nutrition, or It could also just be lack of experience (Venetsanou & Kambas, 2010).
- Poor children from urban areas living in small apartments in blocks could be affected negatively by the lack of enough space that holds them back from gross motor skills development. Oppositely the children from higher social classes may have more room, more variety of toys and other things that the higher class may afford (Venetsanou & Kambas, 2010).

A study (Ferreira et al., 2018) with seven hundred participants (332 boys and 375 girls) aged between 6 and 10 years aimed to examine if motor development is affected by home environment, including socioeconomic status. The results showed that motor development increased as the socioeconomic status increased.

It is also important that we look at other studies that show no effect of socioeconomic status. Previous research (Hindley, 1976) has found the social class not affecting children's performance in development tests until the age of one and a half years. Later studies have suggested that family problems already start influencing a child's development at the age of 1 year (Klebanov et al., 1998). The influence of these factors is far greater than community allowances, in the likes of libraries and parks (Klebanov et al., 1998).

Studies show that the role of a mother is irreplaceable and she is seen as a central person in the child's upbringing and development (Venetsanou & Kambas, 2010). Research has suggested that the mother's role has an increasing effect as the child grows (Durmazlar et al., 1998; To et al., 2001). Factors as low maternal education, maternal depression, parenting practices and low income start playing a role in the child's development at the age of 2 years

(To et al., 2001) and the mother's influence becomes stronger after the child turns 3 years old (Durmazlar et al., 1998).

According to results in a study (Frankerburg et al., 1992), the children with mothers that have a higher education developed earlier in fine motor and language skills. The influence of a mother's education is more highlighted in countries where pre-school education is not provided to all children, this puts children with low educated mothers at a disadvantageous position at school (Frankerburg et al., 1992; Venetsanou & Kambas, 2010). Previous studies (Ittenbach & Harrison, 1990; Najman et al., 1992) are consistent with this mentioned finding. Poor education levels of a mother are often associated with serious financial problems. The children of these mothers have 1.5 to 4 times more possibilities of having developmental backwardness (Najman et al., 1992; Venetsanou & Kambas, 2010).

A study (Jackson et al., 2000) focused on the influence of the mother's education on children from one-parent families, showed that a mother's higher education produced an increased income resulting in reduced financial problems. This had a straight effect on mother's psychology and consequently on children's improved development (Jackson et al., 2000; Venetsanou & Kambas, 2010).

2.1.2 Siblings

Children interact with their siblings, this leads to a social experience with other children (Venetsanou & Kambas, 2010). Research suggests that elder siblings lead the behaviors of the younger siblings (Circirelli, 1975), and the younger sibling imitate the elder's movements (Abramovitch et al., 1979; Lamb, 1978).

Research also tells us that when an older sibling performs a task, often the younger siblings are there nearby and watching (Erbaugh & Clifton, 1984). This results in a lot of time spent in just watching, observing, and studying the performance of the older sibling. Afterwards the younger sibling often replicates the movements of the older brother or sister. He or she does those four times as frequently as the older sibling performing the acts. This shows us that the older sibling contributes as models for their younger brothers or sisters when it comes to motor skills. The girls play a more important role in encouraging their siblings than the boys do (Erbaugh & Clifton, 1984).

2.1.3 Schooling

If we look at the children's normal day schedule from a normal day to day life, then one can surely say that most children spend many hours of a day being in school. Looking at this can lead one to think that it is worth examining the school and the structure regarding the influence it could have on children's development.

A study (Barros et al., 2003) done with the goal of identifying some environmental risk factors for the motor development in two groups, comparing children from two childcare centers and a private school. In the results one could see that the participants from the childcare centers were behind in fine motor skills. It was identified that an appropriate pedagogic orientation was lacking in the childcare centers. This was due to the function focused on at the centers was to simply just look after and feed the children (Venetsanou & Kambas, 2010).

The preschool stage can also affect the children's physical activity levels. Research (Bower et al., 2008; Dowda et al., 2004; Pate et al., 2004) done to examine the physical activity levels of preschoolers shows that which preschool a child attends is a significant predictor for future sturdy physical activity (Venetsanou & Kambas, 2010). Other research (Story et al., 2006) tells us that childcare settings are a possible force when it comes to motor development and tackling childhood obesity (Venetsanou & Kambas, 2010)

A study (Giagazoglou et al., 2008) examined the influence of preschool-type settings (private against public) on children's gross motor development (Venetsanou & Kambas, 2010). Results for this study exposed that those children who were at a private preschool-setting displayed a higher gross motor score than children who were at a public preschool center. This was due to private preschools having a lot of open space for play, gymnasia, courts, and playgrounds. They also included daily exercise physical activity programs. Public preschools had limited space for sports and free play. They also did not include any physical education lessons (Venetsanou & Kambas, 2010).

2.1.4 Social-cultural

The influence of the society and cultural context on development of children has been examined by various researchers. Different cultures have different views on a child's development. Some cultures look at newborns as fragile and they carry them with a sense of

protection all the time, in other cultures people throw them up in the air and catch them. Each culture has its own influence on the development of a child (Venetsanou & Kambas, 2010).

Research shows that in different countries the motor development variates depending on the values important to the culture and its context. A study (Al-Naquib et al., 1999) done on the development of 936 children of Arab ethnic origin and culture showed that in cultures and countries where the primary responsibility of the child is put on mothers, grandmothers, older sisters, or nannies result in the child having poor performance in functional tasks.

In a cross-cultural research (Victora et al., 1990) comparing children's motor development between Brazilian and English children the results showed Brazilians outperformed the English in vigorous activities like running and jumping. This was due to the Brazilians living in a society that focuses on spontaneous, informal, playful and active kinds of behaviors (Venetsanou & Kambas, 2010). Oppositely, the English children seemed to excel in fine motor movement. This due to their culture focusing on developing self-contained, quiet, independent, objective and work-oriented behavior (Venetsanou & Kambas, 2010).

2.1.5 Sex

Motor skills are no exception to sex-related differences. Research has found men to have better throwing accuracy than women (Hall & Kimura, 1995; Watson & Kimura, 1989). This sex difference may have its roots in ancient human times, when women would stay home caring for children and exerting manual labor, whereas men would be out hunting for food (Kimura & Gender, 2004). Regardless of the origin, these differences can also be found in children, implying that sex related differences are occurring from a very young age (Moreno-Briseño et al., 2010; Thomas & French, 1985). Studies have found sex-related differences in obtaining and mastering fundamental motor skills (Flatters et al., 2014; R. Malina, 2004; Thomas & French, 1985), at times in children as young as 3 years of age (Kokštejn et al., 2017; R. Malina, 2004). If some motor skills require size and strength as important factor, adolescent boys due to their larger and more muscular physiques may have an advantage compared to girls (Thomas & French, 1985).

Kokštejn et al. (2017) carried out a study to assess differences between sexes in fundamental motor skills in preschool children of each age group. 325 preschoolers were tested using the Movement Assessment Battery for Children-second edition, among them were 162 boys and

163 girls. Three basic motor domains were tested, manual dexterity, aiming and catching, and balance. The girls were better than the boys in manual dexterity and balance and total test score at ages three and four. At the age five there were no differences between the sexes in any category. The boys scored higher at aiming and catching at age six. Kokštejn et al. (2017) highlight that their findings suggest that motor skills should only be compared between children of the same age and sex.

Research (Sigmundsson & Rostoft, 2003) exploring the motor competence for 4-year-old Norwegian children showed definite sex differences in the development of motor skills. The boys were significantly worse than the girls in manual dexterity and balance, but there were no significant differences between sexes in ball skills.

636 children in age five to eight participated in a study (Pienaar et al., 2022) that determined age and sex developmental differences in fundamental motor skills. The research revealed significant differences in performance with increasing age. Pienaar et al. (2022) found boys to have significantly higher mean values and percentages mastery in running, kicking, and jumping, but found no differences in catching skills. There were most obvious differences between the sexes in the kicking skills with the boys being superior to girls. The boys were slightly better in the mastery of arm action and landing sub-components of jumping. Meanwhile the girls were better during catching of the ball, they also showed slightly higher mastery in jumping components such as the getting ready phase and jumping action.

A study (Dorfberger et al., 2009) investigated sex differences in motor performance in 9-, 12-, and 17-year-olds. Their findings indicated that male participants were benefitting more than female participants in performing trained movement sequences when given equal amount of motor training. In addition, the post-pubertal group, 17-year-olds, showed a significant male advantage.

Research has found boys to be better than girls at throwing in childhood and adolescence (Ehl et al., 2005; Runion et al., 2003). Other studies (Goodway et al., 2003; Hume et al., 2008) report no differences in locomotor skills (Barnett et al., 2010).

Adriyani et al. (2020) researched sex differences in motor coordination and physical activity. There were 200 participants, 95 boys and 105 girls. Using the KTK to assess gross motor

coordination, the results showed significantly higher mean motor quotients for boys compared to girls.

With all the research mentioned above we see that sexes perform better than each other at some motor skills but may also not have any significant differences.

2.1.6 Electronic devices

There is no denying that electronic devices are taking up much time in young children's lives (Chang et al., 2018). Children use these both at home and at school. There are not many studies that have tested the effect of electronic devices, but some research (Niemistö et al., 2019) exists. Niemistö et al. (2019) investigated child, family, and environmental factors associated with young children's perception of locomotor and object control skills. The study had 472 children as participants and their parents were asked questions abouts the child. Niemistö et al. (2019) found that children in the age of five to seven years old that had less access to electronic devices had higher perception in locomotor skills.

2.2 Prior empirical work from Nøtterøy

This chapter will review the previous research on which this study is based. Christiansen and Hagen (2005) conducted a data collection in 1995 and a second data collection in 2004 to compare the differences in children's motor competence. The background for conducting such a comparison was the media's spotlight on the issue of the decline in children's motor competence in modern times due to more sitting and less playtime outside compared to before. To find out whether there had been a decline in motor competence in children, Christiansen started the research.

In 1995, a gross motor test was carried out on seven- and eight-year-old children at a school in Nøtterøy. In 2004, another opportunity to carry out the same gross motor test was taken. This could provide an indication of changes that could occurred in children's motor competence over a nine-year period. With the results of these tests, one could confirm or disconfirm the decline in children's motor competence one had heard about in the media (Christiansen & Hagen, 2006).

When Christiansen and Hagen (2005) was doing this research in 1995 and 2004, there were relatively few research results in Norway that showed the development of motor competence

in children over time. It was often the case that people who worked with children for many years, such as physical education teachers and physiotherapists, believed to see a decline in children's motor competence and physical fitness in general (Christiansen & Hagen, 2005).

A test battery called "Körperkoordiationstest für Kinder", also known as KTK (Schilling & Kiphard, 1974) was used. This test battery tests the gross motor skills such as dynamic balance, hopping and jumping (Christiansen & Hagen, 2005). KTK test battery was used in the study to make the comparison from 1995 and 2004 easy. This played a big part in the reliability and validity of the research. The details of the KTK test battery and these sub-tasks are explained in more specifically in the method section of this paper.

The validity of the KTK-test can be said to be good because the results are relevant for the issue. The measuring instruments are reliable and tests are repeatable (Christiansen & Hagen, 2006). We can say with reasonable certainty that all controllable conditions during the tests were performed in the same way in 1995 and 2004 (Christiansen & Hagen, 2006).

Christiansen and Hagen (2005) explains how the children's age and the geographic area they live in were important to the testing and data collecting in 1995 and 2004. The age of the participants was to be seven- and eight-years old children, and the geographic area where they lived was decided to be Nøtterøy in Norway. More precisely, it was the same school district in Nøtterøy. All this was decided in 1995. In 1995 the children went to Bergan Primary School in Nøtterøy, and in 2004 the children went to the new Oserød Primary School. Christiansen and Hagen (2006) said that one must assume that motor competence depends on the upbringing environment, both by purely physical and geographical conditions, and by the degree of follow-up and facilitation from parents, kindergarten, school and sport clubs.

Christiansen also focused on expecting the socioeconomical status of the families living in Nøtterøy to roughly be the same in 1995 and in 2004. These factors were important because it was known from other studies that both social background and environment can affect children's motor development (Christiansen & Hagen, 2006; Fjørtoft, 2000).

The number of test subjects in 1995 was 50, selected from a population of 86 children. The 50 were selected to ensure the full range of motor competence. In 2004, all children in the second and third grade were asked to join. There were 80 children that participated that year.

When it comes to practical conditions in Christiansen and Hagen (2005) study, strong reliability and validity was wanted. To achieve that as strong as possible, it was important to carry out both tests in 1995 and 2004 as similar as possible. At both occasions the testing was carried out by the same test leader. All sub-tasks were shown to and were tried by the children before the test started. This was done to make sure that everyone participating understood what to do. Children tend to fluctuate in motivation and commitment. Therefore, the test leader had to provide encouragement and motivation by giving comments along the way to make sure the children did their best.

After the data collection, the data was processed and analyzed. First the results were systematized and entered data as anonymized form. So that one could later be able to compare the results between girls and boys, all the results are assessed based on the gender norm for girls. The statistics analyzes were performed with the software package Minitab version 13. Plots of the data showed good adaptation to the normal distribution. T-tests used for two samples based on the observations in a group are independent and normally distributed (Christiansen & Hagen, 2006; Hagen, 2003).

The data from 1995 and 2004 was used to find out if there were any differences between the two groups (group 1: 1995, group 2: 2004). In addition to that the data was analyzed to find possible gender differences. The results showed a higher motoric quotient in 2004 (MQ = 98.1) compared to 1995 (MQ = 96.0) (Christiansen & Hagen, 2005). The difference in MQ was not significant (P = .396). The distribution in relation to KTK's classification alternatives of the test results (Schilling & Kiphard, 1974) showed that the percentage of children with good and normal motor skills increased by 2.8 percentage points in 2004 compared to 1995. This was not a significant difference (Christiansen & Hagen, 2005).

Looking at all the results from the four subtasks, we can see that the clearest difference is in subtask 1. Here the children from 2004 scored 6.5 points higher than the children from 1995. This was significant: (P = .007). Looking at all the other subtasks, there were no significant differences. However, the children from 2004 performed better inn all subtasks except in subtask 3: *Side-jumps with unified legs* (Christiansen & Hagen, 2005).

The survey showed that differences between the genders were higher in 2004 compared to 1995. The girls MQ was higher in 2004 (MQ = 99.8) compared to 1995 (MQ = 96.0), on the

other side the boys MQ decreased from 1995 (MQ = 96.1) to 2004 (MQ = 95.9). However, none of the differences were significant. The girls performed better than the boys in all the test parts. The difference between girls and boys in the "Side-jumps with unified legs" test was significant.

Looking at each of the individual subtasks for the girls, the subtask 1 (backwards balancing on plank) difference from 1995 to 2004 was the biggest of all the subtasks. On all the other three subtasks there were no significant differences between girls 1995 and girls 2004. The girls 2004 scored higher in all the subtasks except subtask 3.

The boys 1995 and boys 2004 were best at two subtask each. Subtask 3 and 4 in favor of boys 1995 and subtask 1 and 2 in favor of boys 2004. There were no significant differences between boys 1995 and boys 2004.

There were no girls in the category *disturbed* in 1995 or 2004. Looking at the boys in the same category, there were boys in this category in both years (1995 and 2004). In the category *striking*, both girls and boys were this category from both years. In 1995 and 2004 there were both girls and boys in the categories *good* and *normal*, combined there were more girls in these categories in 2004 (82.1 %). Comparing to boys there are 74,3 % boys in these categories in 2004. That was seen as a considerable difference (Christiansen & Hagen, 2005). Similarly, the boys in 2004 were represented by 7.9 percentage points higher in the two weakest categories compared to the girls (Christiansen & Hagen, 2005).

The results from the research were engaging for a discussion about children's motor competence. They collided with the medias claims of increasingly weaker motor competence in children in the recent years before the study. The study found surprisingly good results for its own study group (Christiansen & Hagen, 2005).

3.0 Method

Production of valid and reliable knowledge about reality is the purpose of research. To manage this, we need a strategy, and this strategy is called method (Jacobsen, 2015). Method concerns the approaches taken by the researcher to uncover the reality and can be explained as the techniques used to require more knowledge (Jacobsen, 2015). Method of research can be divided into either qualitative or quantitative method (Jacobsen, 2015). This study has a quantitative approach where many units are examined, and information is collected in the form of numbers. Jacobsen (2015) says that quantitative methods are often called extensive methods and taken in use to collect information that can easily be systemized and that can put into computers in standardized form. This allows us to analyze many units together (Jacobsen, 2015). In quantitative data many units are examined, and the researcher wants to generalize the extent of and the correlation between phenomena (Jacobsen, 2015). By collecting empirical data in form of numbers, the researcher focuses on that the phenomena can be studied with great precision and accuracy (Jacobsen, 2015).

The term variables is used in a quantitative approach to describe different qualities to people, groups or situations that may vary, and a constant, which does not vary is the opposite of a variable (Polit & Beck, 2014). The present study aims to discover whether there has been a decline in motor competence among seven- and eight-year-olds from Nøtterøy over the past decades and to map the differences.

3.1 Selection

The children's age and the geographical place for the collecting of data was predetermined by the tests performed in 1995 and 2004. The original tests were performed on seven- and eight-years old children from the same school district (Nøtterøy), which led to the same age group and area for the tests in 2018. The study was in line with the ethical guideline of the University of Agder, and it was reported in 2017 to The Norwegian Center for Recearch Data (NSD – Norsk Senter for forskningsdata). NSD approved the study (see appendix 1). First the year for the present study was going to be 2017, but due to lack of participants the research was delayed by a year to 2018. This change was reported and was approved by NSD.

In 2018 there were 45 participants in this study, 24 girls and 21 boys. They were seven- and eight-year-olds from two different schools in Nøtterøy, Norway. All the participants came from

either Teie primary school or Torød primary school in Nøtterøy, most importantly they were from the same school district. First the schools were approached in a written letter and via e-mail. After getting a positive response from the schools, the parents of the participants were contacted via written invitation letters through the teachers at the school. These letters contained the important information about the tests, this study and its aim. The parents had to sign at the bottom of this letter if they approved that their child could participate in the test and then send the letter back to the teacher (see appendix 2).

All the children at Torød school that gave the letter back to the teachers with the permission of their parents did participate in these tests, however not all the children at Teie school that had the permission from the parents got to participate. That means that the children that did participate from Teie primary school were randomly selected.

3.2 Procedure

This study is a continuation of a previous study and it all started back in 1995. So, the aim has been to have the same procedure each time new data was collected, in 1995, in 2004 and in 2018.

In 1995 and 2004 the school's gymnasium was used, this was also done in 2018, but only at Torød school. Teie school could not make the school's gymnasium available when data was collected, so the data was collected in a small hall by the classrooms of the participating children. It was the same test leader at the data collection of 1995 and 2004, but in 2018 there was a new test leader. The data was collected at both schools over a period of two days in 2018. First at Torød school and then at Teie school.

The teachers randomly selected and sent the children to the gymnasium or the hall by the classrooms in small groups which varied from 3-5 participants at a time. The children were greeted by the test leader here, then they sat down in a small circle. Furthermore, the test leader explained to everyone why they were present. Then the forms for the KTK-tests were prepared with names and ages just after that. The students were introduced to the tasks they were going to go through. Right before the tasks could start it was made sure that each and every participant got to know what they had to do and how they had to do it. This was done firstly by the test leader using time beforehand to become familiar with the tasks, then making sure to show the children each task and at the same time giving accurate and clear massages

to the children. Each child then got to try every task before the test could start. Since children can tend to have fluctuating motivation and the willingness to work, the test leader provided encouragement and motivating comments along the way, so the children did their best. After the children were done with all the task, they were thanked for participating and for doing their best. They were then sent back to the classroom so a new group could come and start. After the tests were done, the test leader went to the teachers to double check the names and ages.

Apart from the fact that Teie school could not provide a gymnasium, the execution of the tests went as planned. The aspects such as low motivation and the willingness to complete a test were a concern before the data collection started, but this can be said to have been under control by the test leader motivating and encouraging the participant throughout the tests. The class teachers were positive and contributed to making sure that the children came to the test with great motivation. The participants said that the tasks were fun and challenging, and with a duration of approximately 20 minutes they managed to maintain their concentration and endurance.

Every participant at Torød school completed their test, but at Teie school not everyone who wanted to participate got to do the KTK-tests. This was due to the lack of time available for data collection, but the ones that were sent to the hall to participate were randomly selected by their teachers. Compared with the practical conditions surrounding the test circumstances in 1995 and 2004, it must be said that all conditions that were controllable by the test leader during the tests in 2018 were done in a similar way as previous. This should be ensuring the validity of this survey.

3.3 Körperkoordiationstest für Kinder (KTK)

In the survey from 1995 the test battery used is called “Körperkoordiationstest für Kinder”, also known as KTK (Schilling & Kiphard, 1974). That led to the same test battery being used in 2004 to have the exact same tests. For the 2018 survey it was important to use the same test battery to be able to compare the results and the data with 1995 and 2004 and to have equal tasks in every year. This test battery has four parts:

3.3.1 Parts:

3.3.1.1 Test 1 Backwards balancing on plank

There are three planks in total. The length of the planks is three meters, there are three different widths that the participants must balance backwards on. The participants walk backwards balancing on each plank and walk backwards as far as they can without touching the floor on the sides of the plank. The test leader counts how many steps each participant takes while balancing. If one take eight or walks the entire length of the plank, then they get a full score on the plank they were balancing on. The test leader demonstrates the test by showing the participants how to balance by walking once forward and once backwards, after that, each participant gets one chance to practice before the actual test starts. The actual test is only completed balancing backwards.

3.3.1.2 Test 2 Skip obstacle with one leg

The participant must skip or jump over the obstacle made from foam mats with one leg. They do it with the right leg and with the left leg. The participant gets to choose which leg they want to start with. If one manages to skip the height of the foam mats successfully, then the height is increased by five centimeters. That means a new foam mat since each foam mat is five centimeters tall when lying flat. To get the test approved by the test leader one must successfully meet three requirements:

1. The leg that is not being used during the skip must not touch the floor during the skipping.
2. One cannot touch the obstacle with any body part while skipping.
3. One must jump over the obstacle with one leg and perform two more skips after the obstacle on the same leg.

The test leader demonstrates how to do the test by showing the whole prosses of the test to the participants. Before the actual test starts each participant gets the chance to practice with two jumps on each leg over one foam mat.

The recommendation on how many foam mats to start with for seven- and eight-year-olds is three mats. That equals the height of 15 cm. Points are given in following order:

Able to jump over the obstacle on first try: Three points.

Able to jump over the obstacle on second try: 2 points.

Able to jump over the obstacle on third try: 1 point.

3.3.1.3 Test 3 Side-jumps with unified legs

In this test the participant must jump side to side with unified legs over a low wood plank that is attached to a small piece of carpet which is 100 cm x 60 cm. Each participant performs as many jumps as they can from side-to-side within 15 seconds. For each jump to be counted by the test leader one must perform the jump with unified legs without touching the wooden plank.

The test leader demonstrates how to do the test by showing the whole prosses of the test to the participants. Before the actual test starts each participant gets the chance to practice once with five side-to-side jumps.

Points are given in the following way:

Each touch of both feet on each side of the wooden plank counts as 1 point. If the participant lands outside of the carpet, the jump does not count. If the legs are not unified when one lands or if the participant lands with one leg on each side of the plank, then 1 point is given as soon at the participant unifies the legs on the "right" side. The total number of jumps is written down in the form.

3.3.1.4 Test 4 Movement laterally

This test is performed by using two square boards (25 cm x 25 cm x 1,5 cm) that stand up from the floor on four rubber studs (4 cm tall). Each participant must stand on one of the boards (board A) with both legs, then place the hands on the sides of the other board (board B). When the test starts the participant lifts the board B from the one side of board A to the other side and places it on the floor about 12-13 cm (half board length) away from the board A. The participant then moves both legs to board B and lifts the board A and perform the same prosses repeatedly with both boards while moving the boards laterally (sideways). One does this as many times as possible within 20 seconds. Each participant does this whole prosses two times and both times the participants move in the same direction facing the same way. For each displacement to count one must use both hands when lifting and moving one board from one side to the other. There is one point given for each time one moves the board with

their hands from one side to the other and one more point for each time one moves his or her own body from one board to the other.

The test leader demonstrates how to do the test by showing the whole prosses of the test to the participants. Before the actual test starts each participant gets the chance to practice five displacements of the board. The participant gets to choose which side they want to move towards (left or right).

In the KTK test battery each of the four subtasks have a motoric quotient (MQ) that is given to every participant. The sum of the MQ's from each test is reported as a collective MQ. These MQ values were introduced during the standardization of the KTK test in the early 1970's (Kiphard & Schilling, 1974). The score is then compared to normally distributed tables that account for age and gender and placed into the classifications introduced by Kiphard and Schilling (1974).

3.4 Statistical analyses.

Classification of the test results in KTK (cf. Kiphard & Schilling, 1974)

Kiphard & Schilling (1974) introduced the standardized scores into the following classifications: *High: MQ* > 131, *good: MQ* 116-130, *normal: MQ* 86-115, *striking MQ* 71-85, *disturbed MQ* < 70.

This classification was designed so that the distribution of motor quotient, *MQ*, for children in a large population, a normal distribution curve is included an average of 100 and a standard deviation of 15.

IBM SPSS Statistics 25 was used to analyzing all the data. The choice of method, previous research and study, previous data and the data's nature helped influence which statistical analyzes were relevant to carry out.

Descriptive data is presented as relative and absolute frequency and average, depending on the nature of the data. The results are presented in the form of tables and graphs, and they are described continuously.

One sample t-test was used to measure differences from 1995 and 2004 to 2018. It was used to analyze both for the whole group and for girls and boys, respectively. Independent sample

t-test was used to analyze and find any differences between the genders in motor competence.

3.5 Validity and reliability

It is common to check if the requirements of validity and reliability are satisfied when either conducting or critiquing research. To ensure the quality of research it is necessary to consider whether the methods and the data collection tools which are used demonstrate reliability and validity. Validity can be explained as the degree to which something is accurately measured and if someone is measuring what they are supposed to measure (Heale & Twycross, 2015; Ringdal, 2007). Reliability can be seen as accuracy of an instrument. Reliability can be explained as the degree to which a research instrument if provided with the same situation on repeated occasions consistently has the same results (Heale & Twycross, 2015). It is expected that the measurements give exactly the same results time after time when used in the same situation to be considered to have high reliability (Ringdal, 2007).

Whether we have coverage in our data for the conclusions we draw, and whether the results are perceived as correct is what internal validity builds upon (Jacobsen, 2015). The extent to which the findings from a study's units can be generalized to others than the ones investigated is external validity (Jacobsen, 2015). In a quantitative method, the purpose is to generalize a large population that is not studied by generalizing from a sample of units we have studied (Jacobsen, 2015).

KTK-test

Körperkoordiationstest für Kinder is separated from other tests mainly of its focus on the gross motor skills and coordination in normal children with or without motoric problems (Vandorpe et al., 2011), bit it can also be used for talent identification (Fransen et al., 2014). Alternative test depend on unrestricted evaluations, which causes that the results may vary between different test leaders (Christiansen & Moser, 2002). The KTK-test is standardized using a plethora of both national and international data(Moser & Dudas, 1996; Schilling & Kiphard, 1974), making it an impartial and quantitative test (Fjørtoft et al., 2003). The test includes four tasks that can be carried out in a room or a small gymnasium and takes approximately 20 minutes.

Elements which may influence the reliability of the KTK test are both dependent on the test leader and the participants. How instructions are conveyed depend on the test leader. Test leader should always follow the procedures described in the KTK-manual and convey them to the participants in an understandable way. For participants to understand exactly how to perform different tasks of the test, this is essential. Instructions should be explained thoroughly, yet shortly, to avoid confusing the participants. For best possible performance from the participants, they should be well rested. Therefore, it is important to consider the time of the day when the tests are carried out. Noontime might be a good time of the day since children often are tired early in the morning or in the afternoon. It is also important to make sure that the participants do not have to many challenging activities before the tests that may affect their energy levels. For a as successful performance of the tasks as possible it is required that both the test leader and the participants have high concentration. For example, a lack in concentration of the participants may lead to them performing poorly, and a lack in concentration of the test leader could lead to misunderstanding when it comes to carrying out the tasks.

The KTK is considered a highly standardized assessment tool (Cools et al., 2009). It is through high explained variance of total score by the item scores (80.9 – 97.7%) that content validity was established, and it is through factor analysis demonstrating all items loading on one factor that construct validity was shown (Schilling & Kiphard, 1974). High levels of test-retest reliability ($r > .85$), inter-rated reliability ($r > .85$) and intra-rater reliability (ICC = .80 - .97) are documented in the test manual (Kiphard & Schilling, 2007; Schilling & Kiphard, 1974). The test is well tested and the various subtests are checked for validity and reliability (Schilling & Kiphard, 1974). The test uses counting and timer as measuring instruments during the subtests. That is one of the advantages of the KTK-test. Since it is always the same that is measured every time the test is carried out, the reliability increases. The KTK was used by Christiansen and Hagen (2005) for both the previous tests carried out in 1995 and 2004 to map differences in gross motor skills in seven- and eight-year-olds. This study, as mentioned before, was a continuation of the research by Christiansen and Hagen (2005). On the basis that the results of the KTK-test are relevant for the present study and, the validity is considered to be good.

4.0 Results

The results from the tests in 2018 were compared to the results from 1995 and 2004.

Comparison between 1995, 2004 and 2018.

Figure 1 gives a descriptive representation of the values of the total motor quotient, *MQ*, for all the participants in 1995, 2004 and 2018.

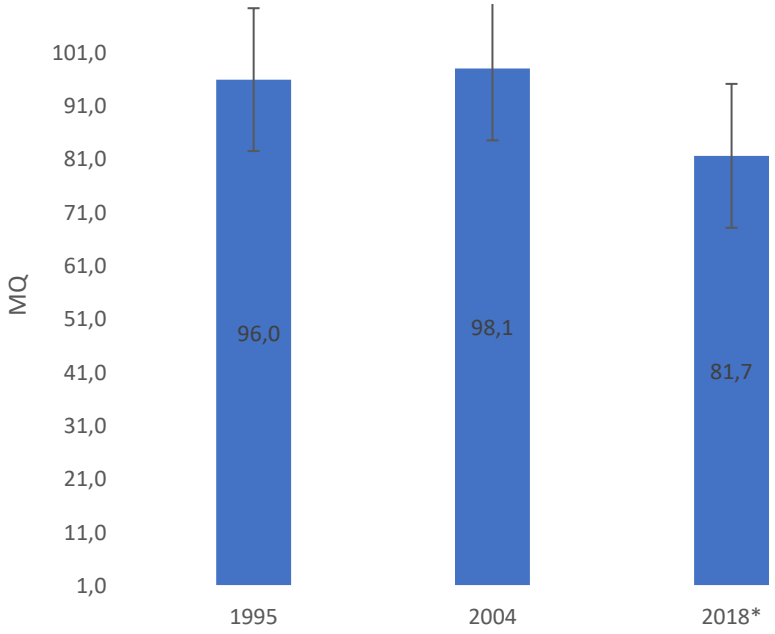

Figure 1. *Average (means) values on KTK-test (motor quotient, MQ) in 1995 (n = 50), 2004 (n = 80), 2018 (n = 45).* Note. Values from 1995 and 2004 are from the study done by (Christiansen & Hagen, 2005). The bar representing 2018 is statistically significant from 1995 and 2004.

In the present study the total score had an average total *MQ* (in 2018) of 81.7 (SD = 13.4), resulting in a decrease of 14.3 point in total score from 1995 to 2018, and a decrease of 16.4 points in total score from 2004 to 2018. The differences between 1995 and 2018 (*P* = .001), and between 2004 and 2018 (*P* = .001) are both significant.

KTK test battery consists of four subtasks. In the table 1 an overview is given on the children's results in each of the subtasks in the KTK-test and their total score.

Table 1: *Motor quotient, MQ, and significance probability (P-Value) of the subtasks and in total on the KTK-test for everyone in 1995, 2004 and 2018. Standard deviation in parenthesis:*

Tasks KTK	***MQ* 1995 (n = 50)**	***MQ* 2004 (n = 80)**	***MQ* 2018 (n = 45)**	***P- Value* 1995 - 2018**	***P- Value* 2004 - 2018**
1: BB	93.0 (12.9)	99.5 (13.6)	93.4 (17.7)	.854	.028
2: SO	95.7 (14.6)	99.4 (13.1)	76.1 (12.2)	.001	.001
3: SJ	101.0 (12.4)	96.9 (14.2)	79.8 (14.4)	.001	.001
4: ML	98.7 (10.9)	98.9 (14.0)	94.3 (15.7)	.068	.057
Total score	**96.0 (13.4)**	**98.1 (13.5)**	**81.7 (13.4)**	**.001**	**.001**

1995 and 2018:

There are significant differences in two of the four subtasks. 1995 children were better than the 2018 children in three of the four subtasks.

For the subtask 1: Backwards balancing on plank (BB) - the participants in 2018 scored a *MQ* of .4 points higher than the participants in 1995. The 2018 children were better than the 1995 children in this subtask, but not significantly.

For the subtask 2: Skip obstacle with one leg (SO) - the participants in 2018 scored a *MQ* of 19.6 points lower than the participants in 1995. The 1995 children were significantly (*P* = .001) better than the 2018 children in this subtask.

For the subtask 3: Side-jumps with unified legs (SJ) - the participants in 2018 scored a *MQ* of 21.2 points lower than the participants in 1995. The 1995 children were significantly (*P* = .001) better than the 2018 children in this subtask.

For the subtask 4: Movement laterally (ML) - the participants in 2018 scored a *MQ* of 4.4 points lower than the participants in 1995. The 1995 children were better than the 2018 children in this subtask, but not significantly.

2004 and 2018:

There are significant differences in three of the four subtasks. 2004 children were better than the 2018 children in all four subtasks.

For the subtask 1: Backwards balancing on plank (BB) - the participants in 2018 scored a *MQ* of 6.1 points lower than the participants in 2004. The 2004 children were significantly (*P* = .028) than the 2018 children in this subtask.

For the subtask 2: Skip obstacle with one leg (SO) - the participants in 2018 scored a *MQ* of 23.3 points lower than the participants in 2004. The 2004 children were significantly (*P* = .001) than the 2018 children in this subtask.

For the subtask 3: Side-jumps with unified legs (SJ) - the participants in 2018 scored a *MQ* of 17.1 points lower than the participants in 2004. The 2004 children were significantly (*P* = .001) than the 2018 children in this subtask.

For the subtask 4: Movement laterally (ML) - the participants in 2018 scored a *MQ* of 4.6 points lower than the participants in 2004. The 2004 children were better than the 2018 children in this subtask, but not significantly.

Table 2 shows the percentage distribution for the participants from Nøtterøy in the same classification alternatives in 1995, 2004 and in 2018.

Table 2: *Percentage distribution in Kiphard & Schillings classification alternatives in 1995, 2004 and 2018. Number of participants in parentheses:*

Category	**Kiphard & Schillings distribution.**	**Nøtterøy 1995 (n = 50)**	**Nøtterøy 2004 (n = 80)**	**Nøtterøy 2018 (n = 45)**
High	2 %	0 %	0 %	0%
Good	14 %	4 % (2)	10 % (8)	0%
Normal	68 %	72 % (36)	68.8 % (55)	35.6% (16)
Striking	14 %	22 % (11)	18.8 % (15)	44.4% (20)
Disturbed	2 %	2 % (1)	2.5 % (2)	20 % (9)

Table 2 shows a slight shift in the distribution from 1995 to 2004, but there were bigger shifts in distribution between from both 1995 to 2018 and from 2004 to 2018.

Percentage distribution between 1995, 2004 and 2018:

High:

No children were categorized in *high* (0%) in all the three years of the tests.

Good and normal:

In 1995 there was a total of 76 % children that were categorized in *good (n* = 2) and *normal (n* = 36). In 2004 this had increased to 78.8 % children that were categorized in *good (n* = 8) and *normal (n* = 55). In 2018 the percentage number decreased to a total of 35.6 % children that were categorized in *good (n* = 0*)* and *normal (n* = 16).

Striking and disturbed:

In 1995 there was a total of 24 % children that were categorized in *striking (n* = 11) and *disturbed (n* = 1). In 2004 this had decreased to 21.3 % children being categorized in *striking (n* = 15) and *disturbed (n* = 2). In 2018 the percentage number increased dramatically high to a total of 64.4 % children being categorized in *striking (n* = 20*)* and *disturbed (n* = 9).

Differences from 1995 to 2018 and 2004 to 2018 for girls and boys:

In the table under an overview is given on the results of both the girls and the boys in each of the subtasks in KTK-tests and a total score of *MQ*.

Table 3: *Motor quotient, MQ, on the subtasks and in total on the KTK test for girls in 1995, 2004 and 2018, and for boys in 1995, 2004 and 2018. Standard deviation in parentheses:*

Tasks KTK	***MQ* girls 1995 (n = 24)**	***MQ girls* 2004 (n = 45)**	***MQ* girls 2018 (n = 24)**	***MQ* boys 1995 (n = 26)**	***MQ* boys 2004 (n = 35)**	***MQ* boys 2018 (n = 21)**
1: BB	92.4 (11.9)	100.3 (12.4)	96.0 (16.0)	93.5 (14.0)	98.5 (15.2)	90.6 (19.4)
2: SO	97.4 (12.9)	99.7 (13.0)	76.4 (13.2)	94.1 (16.2)	98.9 (13.4)	75.8 (11.3)
3: SJ	102.1 (12.2)	99.6 (14.5)	76.9 (15.8)	100.0 (12.8)	93.3 (13.1)	83.2 (12.2)
4: ML	96.6 (11.1)	100.0 (13.1)	95.7 (15.5)	100.7 (10.6)	97.3 (15.1)	92.6 (16.2)
Total score	**96.0 (12.2)**	**99.8 (12.9)**	**82.1 (14.7)**	**96.1 (14.7)**	**95.9 (14.1)**	**81.2 (12.1)**

Girls:

Results on Motor quotient, *MQ*, on the subtasks and in total on the KTK test for girls in 1995 and 2018:

Results for total score on *MQ* showed that the girls in 1995 performed better than the girls in 2018. The difference of 13.9 points in favor of 1995 girls was significant (*P* =.001). The girls 1995 scored significantly higher in subtask 2 and 3 and were better in all the subtasks except subtask 1.

Results on Motor quotient, *MQ*, on the subtasks and in total on the KTK test for girls in 2004 and 2018:

Results for total score on *MQ* showed that the girls in 2004 performed better than the girls in 2018. The difference of 17.7 points in favor of 2004 girls was significant (*P* =.001). The girls 2004 scored significantly higher in subtask 2 and 3 and were better in all the subtasks.

Looking at each of the individual subtasks for the girls, in subtask 1 (backwards balancing on plank) and subtask 2 (skip obstacle with one leg) the differences are not significant between girls 2004 and girls 2018. The girls 2004 score higher in all the subtasks.

Boys:

Results on Motor quotient, *MQ*, on the subtasks and in total on the KTK test for boys in 1995 and 2018:

Results for total score on *MQ* shows that the boys in 1995 performed better than the boys in 2018. The difference of 14.9 points in favor of 1995 boys was significant (*P* =.001).

Looking at each of the individual subtask results for the boys showed that boys 1995 were better at all the four subtasks. They were significantly better in subtasks 2 and 3.

Results on Motor quotient, *MQ*, on the subtasks and in total on the KTK test for boys in 2004 and 2018:

Results for total score on *MQ* shows that the boys in 2004 performed better than the boys in 2018. The difference of 14.7 points in favor of 2004 boys was significant (*P* =.001).

Looking at each of the individual subtask results for the boys show that boys 2004 are best at all the four subtasks, all the subtests except subtasks 4 (movement laterally) have significant differences between boys 2004 and boys 2018.

Both the boys and the girls better performances from 1995 and 2004 were the reason for significance in the collected *MQ* when compared to 2018.

Classification of the test results in KTK by gender (cf. Kiphard & Schilling, 1974)

In table 4 an overview is given of the gender distribution according to the Kiphard & Schilling's classification.

Table 4: *Percentage distribution in Kiphard & Schillings classification alternatives in 1995, 2004 and 2018 in relation to gender. Girls 1995, 2004 and 2018, and boys 1995, 2004 and 2018. Number of participants in parentheses:*

Category	Girls **1995** **(n = 24)**	Girls **2004** **(n = 45)**	Girls **2018** **(n = 24)**	Boys **1995** **(n = 26)**	Boys **2004** **(n = 35)**	Boys **2018** **(n = 21)**
High	0 %	0 %	0 %	0 %	0 %	0 %
Good	4.2 % (1)	13.3 % (6)	0 %	3.8 % (1)	5.7 % (2)	0 %
Normal	75 % (18)	68.8 % (31)	41.7 (9)	69.2 % (18)	68.6 % (24)	28.6 % (6)
Striking	20.8 % (5)	17.8 % (8)	37.5 % (10)	23.1 % (6)	20 % (7)	52.4 % (11)
Disturbed	0 %	0 %	20.8 % (5)	3.8 % (1)	5.7 % (2)	19 % (4)

We can see that a performance difference exists between the genders. There are no girls in the category *disturbed* in 1995 or 2004, but in 2018 there are 20.8 % girls in this category. Looking at the boys in the same category, there are boys in this category in all the three years (1995, 2004 and 2018). When we look at the category *striking*, we see both girls and boys in this category from all three years. Boys 2018 have the highest percentage in this category (52.4%), comparing to the girls 2018 there are 37.5 % girls in this category. In 1995 and 2004 there are both girls and boys in the categories *good* and *normal*, combined there are more girls in these categories in 2004 (82.1 %). Comparing to boys there are 74.3 % boys in these categories in 2004. That is a considerable difference according to Christiansen and Hagen

(2006). Similarly, the boys in 2004 are represented by 7.9 percentage points more in the two weakest categories compared to the girls. In 2018 there are no girls or boys in the category *good,* and there are only 41.7 % girls in the category *normal* and 28.6 % boys in the same category. These differences in percentage are considerably lower in 2018. The boys in 2018 are represented by 13.1 percentage points more in the two weakest categories compared to the girls.

5.0 Discussion

The aim of this research was to discover whether there has been a decline in motor competence among seven- and eight-year-olds over the past two decades and to map the differences. This study was a continuation of an earlier study that was carried out in 1995 and 2004 to find out if there had been a decline in gross motor skills in children. It was initially thought there would be a noticeable change in recent decades. The results from the test do not tell the whole story about a child's motor competence, but it rather maps parts of the complex system. The KTK-test battery tests a range of a child's gross motoric skills. The tested motoric skills give a measurement of how good a child is in these four exercises, while also giving an indication of the child's general motoric control.

Differences in gross motor skills of children in Nøtterøy from 1995 and 2004 to 2018

The results in table 1 showed a significant decrease in the overall motor quotient of research group. There was a decrease of 14.3 points from 1995 to 2018 and a significant decrease of 16.4 points from 16.4 points from 2004 to 2018. There were significant changes in subtask 2 (skip obstacle with one leg) and 3 (side-jumps with unified legs) in favor of the children 1995 compared to 2018. Children from 2004 were significantly better in all four subtasks compared to 2018.

There is research that supports the findings of the present study. Tester et al. (2014) identified a decline in skills level for young children. Vandorpe et al. (2011) evaluated the suitability of KTK as an assessment instrument for gross motor coordination. Findings showed a decline in motor coordination, but improvements were found in tasks relying on strength and speed. Koeppel et al. (2022) research confirmed a general decline in for coordinative abilities. Bjelland and Klepp (2000) found that the activity levels of schoolchildren in Norway had decreased compared to previous years

On the other hand there is not much but some research that doesn't support the present study. Roth et al. (2010) found no universal decline in the motor skills, only in some motor skills tasks. Roth et al. (2010) compared results from 2007 to 1973, 1985 and 1989. The focus was on weight, height, and motor performance changes and 726 preschool children were tested. There were finding on significant improvement in standing long jump in 2007 compared to 1989, and significant decline in target throwing in 2007 compared to 1985.

We must look at research for potential consequences of high and low motor competence. Lubans et al. (2010) found that children with high motor competence have positive outcomes in physical activity and weight status. Studies show that motor competence predicts levels of physical activity and physical fitness in later life (Barnett, Van Beurden, Morgan, Brooks, Beard, et al., 2008; Jaakkola et al., 2016; Lopes et al., 2011). The likelihood of participation in physical activities is significantly impacted by impaired coordination (Smyth & Anderson, 2000). Research suggests that overall performance on different physical fitness components is significantly impacted by motor competence (Cairney et al., 2007; Hands, 2008; Hands & Larkin, 2006). Research finds kids with greater control over their motor skills more likely to have better physical form as young adults (Barnett, Van Beurden, Morgan, Brooks & Beard, 2008). The child's confidence increases when they possess the skills required to succeed in an activity or game (Schoemaker & Kalverboer, 1994).

Research (Hands & Larkin, 2006) finds that problems with performing and mastering many basic movement skills essential for full participation in game, sports and other recreational activities are consequences of reduced or low motor competence in children. This could potentially lead to reduced physical fitness in one's life. Children with poor coordination and poor motor competence are less physically active (Castelli & Valley, 2007; Lopes et al., 2011) and less fit (Hands & Larkin, 2006; Wrotniak et al., 2006) compared to their peers in school (Haugen & Johansen, 2018). Poor physical self-perception, reduced motivation to participate in physical activity, less contact with age peers, and consequently fewer opportunities to develop proficient motor skills and adequate fitness levels can all be consequences of long-term low motor competence (Cantell & Crawford, 2008).

One cannot give a definite explanation to why there is a decline. We must look at other studies that find similar findings, or not similar findings. Further research is needed to discover he reasons behind the decline.

Table 3 showed an overview of the total MQ of the sexes. We could see a total difference of 13.9 points in the favor of girls 1995 compared to girls 2018, and a total difference of 17.7 points in favor of girls 2004 compared to girls 2018. Both decreases in total MQ of girls were significant. The girls 1995 and girls 2004 were significantly better in subtask 2 and 3 compared to 2018. There was a significant decrease for the boys in the present study as well, 14.9 points decrease from 1995 and a decrease of 14.7 points from 2004. The boys 1995 were significantly

better in subtask 2 and 3 compared to 2018, and boys 2004 were significantly better inn subtask 1, 2 and 3 compared to boys 2018. Christiansen and Hagen (2005) found a non-significant improvement of 2.1 points in total MQ between 1995 and 2004, and there were no significant changes in total MQ for the sexes from both years.

In the present study the girls scored higher than the boys in 1 (Backwards balancing on plank), 2 (skip obstacle with one leg) and 4 (movement laterally). All these subtasks require some degree of balance. The boys scored higher than girls in subtask 3 (Side-jumps with unified legs). Subtasks 1, 2 and 4 require good balance in performance of the movements. This matches with findings of Kokštejn et al. (2017) and Sigmundsson and Rostoft (2003) where the girls performed better than boys in balance. The present studies finding do not show similar results with the research of Adriyani et al. (2020). Adriyani et al. (2020) research found the boys significantly better than girls in mean motor quotients, the boys outperformed the girls in all tasks but scored similar in the walking backwards (Backward balancing on plank). Tester et al. (2014) found a decrease in females over the past two decades prior to 2012.

Looking at the research of Pienaar et al. (2022) there is a match in findings of the present study. The boys performed better than girls in jumping. Pienaar et al. (2022) found that boys were slightly better in the mastery of arm action and landing sub-components of jumping. Meanwhile the girls showed slightly higher mastery in jumping components such as the getting ready phase and jumping action. This may explain the boys scoring higher than girls in subtask 3 and the girls scoring higher than boys in subtask 2. Side-jumps with unified legs require some control of arm and leg movements while landing and jumping. Skipping obstacle with one leg requires the performer to get ready before the jump and then have good jumping action to perform a jump over the chosen obstacle. Adolescent boys due to their larger and more muscular physiques may have an advantage compared to girls in motor skill that require size and strength (Thomas & French, 1985). It is difficult to say if that same reason may apply in the years of childhood. It is difficult to point out why the scores for sexes are like they are, Goodway et al. (2003) and (Hume et al., 2008) found no differences in locomotor performance between the sexes. One cannot give a definite explanation to why the sexes perform like they do even though there might be other studies that find similar performance in findings, or not similar findings. We can only show to research that showed sex related differences are

occurring from a very young age (Flatters et al., 2014; R. M. Malina, 2004; Moreno-Briseño et al., 2010; Thomas & French, 1985) and further research on the issue may be needed.

The distribution in Kiphard & Schilling's classification alternatives based on aggregate motor quotient also shows a negative tendency in the present study. Table 2 showed that no children were categorized in high (0 %) in all three years. As mentioned earlier we can see that in 1995 there was a total of 76 % children that were categorized in good and normal, in 2004 this had increased to 78.8 %, but in 2018 a total of 35.6 % children that were categorized in good and normal. In 1995 there was a total of 24 % children that were categorized in striking and disturbed, in 2004 this had decreased to 21.3 %, but in 2018 the percentage number increased dramatically to 64.4 % children.

This shows a strong shift towards more children in the striking and disturbed categories and fewer children in the good and normal categories. This is the opposite of what was seen in between 1995 and 2004 by Christiansen and Hagen (2005). Vandorpe et al. (2011) found increases in the striking and disturbed categories and decreases in the good category as well between 1974 and 2008, but in much smaller percentages. The present study finds much higher percentages. This shift is a reason to be concerned and more research on this issue should be carried out. This corresponds to what Christiansen and Hagen (2005) mentioned about Säfvenbom's statement that there is a large gap in skills between children, and that the proportion of children performing in good and normal levels are becoming less and less, while it becomes constant more in the worst categories. This statement did not correspond with the previous findings, but now seems more fitting.

There are not many studies like the present study's in Norway in recent times. Not many have tested groups of same age at three different occasions over such a long time, and there are no previous results to compare new results with for many other researchers. The present study continues and builds on the work Christiansen and Hagen (2005) did in 1995 and 2004. Therefor one could only speculate the decrease in motor competence in Norwegian children before the present study's findings in 2018 were compared to the findings of Christiansen and Hagen (2005). To be a unique study with previous results to compare the new findings with was of huge advantage. However, the results cannot be generalized for the whole of Norway or a big part of Norway. The findings tell that there has been a decrease in the children form

Nøtterøy over the past decades, but more research is required to further investigate the issue on a national level.

Back in 1995 and 2004, it was thought that there would be a decline in motor skills since Norwegian media had made statements about negative developments in children's motor skills and physical fitness (Christiansen & Hagen, 2005). There were few comparable studies then of children's motor skills that could say anything about changes over time. In the previous results in findings of Christiansen and Hagen (2005), a small improvement in motor skills was seen, it was disproved that it looked so negative for the children back then. The decline in Nøtterøy children's motor skills from 1995 and 2004 to 2018 ones again opens the discussion on whether the Norwegian children have poorer motor skills than before.

This survey's findings say nothing about cause and effect, but as highlighted by Christiansen and Hagen (2006), one must assume that the children's growing up environment has an impact on motor skills. That is precisely why it was crucial for the survey's credibility that the test in 2018 was carried out in the same geographical area as in 1995 and 2004.

Environmental factors that affect motor competence

Nøtterøy was a separate municipality before but has been a part of Færder municipality since January 2018. Nøtterøy is rich with opportunities and gives the residents closeness to both the sea and forest, which means that they have easily accessible to various outdoor life opportunities. There are mainly residential areas combined with terraced houses and apartments in the area. The socioeconomical status in the area is in the median range (www.faerder.kommune.no: Helsetilstand og påvirkningsfaktorer i Færder kommune. *Kommuneplanens samfunnsdel 2018-2030*). There is a wide range of sports and activities in the municipality, this helps increase the physical activity in free time. Looking at this description of Nøtterøy and the one given by Christiansen and Hagen (2005), it seems that the geographical area provides the children with similar opportunities for physical activities at the time of present study as before. It is difficult to point at factors such as the geographical area and the socioeconomic status to be the reason for the decrease in motor competence in Nøtterøy. The geographical area is controlled, and it offers somewhat the same opportunities for physical activity as before. The socioeconomic status of families in the area seems to be in the same range as in 1995 and 2004.

The socioeconomical status of a family can be one of the factors that effects the children in the family and their motoric and physical development. Klebanov et al. (1998) suggested that family problems already start influencing a child's development at the age of 1 year and that this influence is far greater than community allowances, in the likes of libraries and parks. Venetsanou and Kambas (2010) found a relation between a child's motor development and their socioeconomic status. As mentioned before, the socioeconomical status in Nøtterøy is in the median range, as it was in previous tests by Christiansen and Hagen (2005). Its reported that lower social class children score worse that the children from middle or high social class in motor development assessment batteries (Bax & Whitmore, 1987; Camp et al., 1977; Giagazoglou et al., 2005; Krombholz, 1997; Larsson et al., 1994). Ferreira et al. (2018) aimed to examine if motor development is affected by home environment, including socioeconomic status, and found that motor development increased as the socioeconomic status increased. It is difficult to say if this could be one reason or not for the decrease in motor competence found in the present study, as it is reported to be in the same category as in 1995 and 2004 and is in addition to that controlled by the geographical area being the same. Future research of this sort could befit from collecting and charting the income of the children's parents and analyzing the motor competence with that.

One factor that may be affecting the decrease in children's motor competence today might be that children use more time in front of the TV and screens. Social media, movies, TV, and tv-games are taking up more and more of the children's time throughout the day. This may be leading to less physical movement, which again effects the physical and motor development. Niemistö et al. (2019) found that children in the age of five to seven years old that had less access to electronic devices had higher perception in locomotor skills. However, there are not many studies on the relationship between electronic devices and motor skills of children, and more research is needed to investigate the correlation between motor competence and use of electronic devices further. Therefore, we cannot conclude if these was affecting the motor competence in the participants of the present study.

A varied range of sports helps to increase the opportunities for an active life for children. Involvement of gross motor skills can be seen in many physical activities and are essential in performing sport-specific skills (Barnett et al., 2009; Graf et al., 2004; Okely et al., 2001; Westendorp et al., 2011; Wrotniak et al., 2006). Well-developed gross motor skills contribute

in a positive way towards ones activities of daily living (Watkinson et al., 2001) and can be seen as building blocks for the growth of more complicated motor and sport-specific skills (Stodden et al., 2008a; Wall, 2004). Participating in sports might be an effect of positive evolvement in motor skills, the children were not asked this in 1995 and in 2018, but in 2004 86% of the participants were active in sports (Christiansen & Hagen, 2006). A positive relationship between gross motor skills and organized sports participation is seen in several studies (Barnett et al., 2009; Okely et al., 2001; Ulrich & Sport, 1987). The data from 2004 showed that the children who participated in sports were significantly better than the children who didn't participate in sports (P = .043). Since the children in 2018 weren't asked about their participation in sports, one could only speculate that perhaps the decline in motor skills may be due to less participation in sports.

Another thing that could be a factor in a child's motor skill development in a positive or in a negative way is the school and the focus of the school on, and its availability to a lot of open space for play, gymnasia, courts, and playgrounds. Access to this may increase daily exercise physical activity in children. If we look at the children's normal day schedule from a normal day to day life, then one can surely say that the most children spend many hours of a day being in school. Looking at this can lead one to think that it's worth examining the school and its structure regarding the influence it could have on children's development.

Giagazoglou et al. (2008) examined the influence of preschool-type settings on children's gross motor development. Private preschools had a lot of open space for play, gymnasia, courts, and playgrounds, and included daily exercise physical activity programs. Public preschools had limited space for sports and free play. They also did not include any physical education lessons (Venetsanou & Kambas, 2010). Private preschool-setting displayed a higher gross motor score in children. Both the schools where the data was collected in 2018 had access to open play areas, courts, woodland, and trees to climb in. However, there was a lack of climbing stands in the school yard, one could speculate that this lack may affect the gross motor skills. There was a lot of open space made of asphalt and hard surface. This spacious school yard gives the possibility of playing different ball sports, play ball against the wall, jumping rope, different jumping activities, running activities and run chase and catch games. The opportunity for these activities inspires the pupils to a lot of free play and different opportunities to develop the gross motor skills. As mentioned before, both schools had access to woodland and trees

nearby. According to Fjørtoft (2000), play and activities in nature provide, among other things, better balance and coordination than if you only have an asphalt surface to play on (Christiansen & Hagen, 2006).

Christiansen and Hagen (2006) said that the participants in their study from Nøtterøy had good supporters around them in form of teachers, parents and coaches who were keen to give the children opportunities for physical activity. Christiansen and Hagen (2006) also said that it seems like when the right conditions are in place for challenging and varied activities, the children's motor skills, endurance and physical parameters will develop normally. This seemed as a reasonable explanation for the results they saw, but they did not conclude this as a define cause. Barros et al. (2003) found that children from the childcare centers were behind in fine motor skills compared to children from a private school. Lack of an appropriate pedagogic orientation was identified in the childcare centers. Could there be a decrease in pedagogic orientation, structure, and support around the children in 2018? Could this have a connection to the decline in their motor skills compared to 1995 and 2004?

In the previous study by Christiansen and Hagen (2006) they tell us that the examination school they tested at was always focusing on offering good and versatile physical education to the children. That could have been a factor behind the maintenance of the high scores between 1995 and 2004. We have no knowledge of how the examination schools in 2018 organized their physical education classes, but in general a school in Norway has to offer children 478 hours (of 60 minutes) of physical education from first grade to seventh grade. That's just under 70 hours (68,28) of physical education in a year filled with versatile activity decided by state curriculum. So, we can assume that both examination schools offered at least that to their pupils. One could speculate that this number of hours with physical education are too low. That the number of hours may have to be increased to give children even more physical education, which challenges and develops their gross motor skills even more. The reason for the decline cannot be detected through the investigation in this study. One can only assume and speculate, but no definite causation can be detected.

As mentioned earlier, children interact with their siblings. Circirelli's (1975) research suggests that elder siblings lead the behaviors of the younger siblings. The younger sibling imitates the elder's movements (Lamb 1978, Abramovitch, Corter et al. 1979). Often the younger siblings are there nearby and watch their older sibling performing a task. As well, the younger siblings

spend a lot of time in just watching, observing, and studying the performance of the older sibling before they try to replicate the movement. The older sibling may be role models for their younger brothers or sisters when it comes to motor skills. This could mean that some of the children from Nøtterøy in 2018 may have role models in a form of an older sibling who they try to copy. Which also could lead to the question of could this decline in motor competence have been seen years earlier? The children may also become role models for eventual younger siblings, which raises the question of could they affect the motor competence of their younger siblings in a negative way? We don't know for sure. This may not be proven without further and more detailed research done on siblings and their function in motor development in the family through time. This survey's results and analyses do not tell us anything about the cause behind the decline.

5.1 Method discussion

This present study is unique in the way it can provide information about the development of motor competence through time in the last decades. First, it has focused on seven- and eight-year-old children in all the years the data was collected, so the test groups were the same age. Further, it has tests from the same geographical area and the same school district in all three years. This provides very useful information on how the development of children's motor competence in the same area has developed during the time between 1995, 2004 and 2018. This information may benefit the society with the reality of children's development levels of motor competence today compared to before.

The purpose of all scientific research is an objective and neutral study so that the answers are trustworthy. In practice, an error-free study is impossible to achieve. Based on the study design, methods and research procedures, certain methodological limitations of the study must be discussed.

Design

The total number of participants in this study was 45 seven- and eight-year-old children, out of the 45 participants 24 were girls and 21 were boys. They were from two different schools in Nøtterøy, Norway, but most importantly they are from the same school district. The children's age and the geographical place and school district were all predetermined by the tests performed in the study of Christiansen and Hagen (2005). The present studies tests were

carried out in 2018 and compared to tests from 1995 and 2004 performed by Christiansen and Hagen (2005). One of this study's strengths are that the age, school district and geographical area was the same at all three years the data was collected. This becomes kind of a base for the tests carried out in the previous and in the present study. With these factors remaining the same, one can know that the children may have had same kind of nature structure around them at the of all three tests (1995, 2004 and 2018), the area provides easy availability to the forest, the sea, and other outdoor opportunities. When factors like age, geographical area and school district remain the same at time of all the tests then one can precisely compare the results with each other and draw conclusions. This present study is unique in its way due to it having data available from previous years and being able to compare todays results with those that are up to 23 years old. It is also a strength that it can see data from both sexes and compare these too previous data as well, and se differences between sexes.

One limitation of this present group may be its size, in 1995 there were 50 participants and in 2004 there were 80 participants compared to 45 participants in 2018. It's hard to give some concrete answer as to how many participants a sample should contain (Johannessen et al., 2010). This must be considered in relation to the study's purpose. One may argue that there isn't a big difference between the number of participants in 1995 and 2018, and that is true, but 2018 has the smallest number out of the two with five participants less. In 2018 there were 35 fewer participants than in the group in 2004. The number of participants in 2018 is the smallest out of the three. This leads towards us considering the present group a bit too small in connection to statistic strengths of the study.

In addition to that, one other weakness of this study might be that not all the participants that agreed to participate from Teie school in 2018 got to participate. At both schools the teachers randomly selected the children and sent them to do the gymnasium or the room where the KTK-tests were held. At Torød school all the children who agreed and were present at school at the time of data collection got to participate. However, not all who said yes to participate at Teie school got to participate due to limited time, and that those who participated were randomly selected may have affected the results of this study. One can only speculate which way the results would have pointed if everyone was allowed to participate.

In 2004 the children were asked about their involvement in sports, 86 % of them were active in sports. Christiansen and Hagen (2005) found that those who were active in sport activities

scored higher than others and were significantly better. One weakness of the present study is that the children in 2018 were not asked about their involvement in sports. By having that information, one could have seen if it is still the case that those involved in sports scored better.

Körperkoordiationstest für Kinder

Körperkoordiationstest für Kinder (KTK) was used to map the children's motor competence at all three data collection points (1995, 2004 and 2018). The KTK test is intended to be an objective and quantitative test which, based on a large material, is standardized to measure motor skills in children and young people. This test is standardized for use on children and young people between the age 5 and 15 years (Schilling & Kiphard, 1974).

The strengths of the KTK test are that the tasks and assessment criteria differentiate well at all motor levels (Schilling & Kiphard, 1974). There is no upper limit or maximum performance in KTK, which means that each individual test subject can reach their full potential. The various tests are laid out in such a way that equal consideration is given to ensure that those with the weakest motor skills can show what they are capable of doing in each of the subtest in the KTK. There is no upper limit that must be cleared to get points in the test (Christiansen & Hagen, 2005). Another thing that can be seen as a strength is how the children to be tested easily understand and perform the unfamiliar movements. KTK is reported to have a high reliability, and its validity is tested carefully, but studies show that its validity requires further evaluation (Iivonen et al., 2016). Our experience with the KTK test is that one must motivate and encourage the test participants highly throughout the entire data collection to get the best out performance from them. The test participants can easily be disturbed by factors around them and lose concentration. That makes it difficult to know whether the children are showing their full potential in the various tests. This is considered relevant to mention here after collecting data for this study. As mentioned before, the aspects such as low motivation and the willingness to complete a test were a concern to the test leader. Nevertheless, we do not consider this to be such a big problem that it spoils the use of the test results since the test leader was aware of this and tried to minimize this problem by motivating the participant throughout the tests. In addition to that the children came to the test with great motivation as the teachers contributed by talking positively about the tests. The response from the participants was that they found the tasks to be challenging and fun. The duration of 20

minutes to 25 minutes was not too long and they managed to maintain their concentration and endurance.

Earlier it was mentioned that one of the KTK-tests strengths can be how easily children understand and perform the unfamiliar movements required by the different subtests. However, being there and collecting data firsthand and experiencing the children's behavior along the way showed a difference in how well the children understood the tasks that were instructed. A child's cognate understanding of a task can be a factor that influences their results. To minimize this effecting the results the test-leader made sure to give the same instructions to all the children. This was to make sure that the test-leader's instructions did not influence the performance and results in different ways. One can only speculate how much the cognitive understanding plays into the final test results. However, there is reason to assume that it plays a role among other factors as well, since the children are somewhat unknown with the movement tasks.

Among the limitations of the KTK test may be the limited time the participants have to learn the exercises. Some might find the subtasks challenging due to the limited time of just a few minutes they are given to get to know the movements beforehand. Others might not find this challenging. In some cases, this can affect the participants ability to perform at their best because the subtask movements of the exercise are not properly learned (Cools et al., 2009). In the present study the children seemed to understand the instructions on the subtasks and the movements well and seemed to do their best.

A person's ability to execute different motor acts, including fine and gross motor skills can be described as motor competence (Haga & development, 2008; Henderson & Sugden, 1992b). Whether the necessary elements to quantify a person's motor skills are contained in the KTK test can be debated. It is also difficult to conclude if the values generated from the subtests reflect correctly upon the concept of motor skills and its components. However, this is difficult to conclude since there is no benchmark to test the method up against.

The participants are faced with unknown challenges in the KTK test, so the learning aspect is limited, and the experience background becomes less decisive. Initially, components such as the mental, social, and physical level are also eliminated. However, it can be discussed

whether it is possible to completely exclude these factors. This due to the thinking that every action is an interaction between the organism, the task, and the environment.

6.0 Conclusion

This study aimed to discover a decline in gross motor skills among seven- and eight-year-olds in Nøtterøy over the past decades. The survey shows that the children in Nøtterøy have had a significant decrease in gross motor skills over the period of 23 years (1995-2018) and 14 years (2004-2018). There was a significant decrease of 14.3 points from 1995 to 2018 and a significant decrease of 16.4 points from 2004 to 2018. The percentage distribution showed a massive shift towards the striking and disturbing categories. Decreases in total MQ of both girls and boys were significant compared to 1995 and 2004. Differences between the boys and girls showed that girls scored better that the boys in subtask 1, 2 and 4. However, girls scored slightly better than boys with 0,9 points higher in total MQ.

The results from Nøtterøy show that the concerns for today's children having lower motor competence compared to before may be strong. It is assumed that the children's growing up environment has an impact on motor skills. However, despite having same opportunities with woodland, the sea, and several other possibilities for physical activity in the area as before, the children in 2018 show a significant decline. This may indicate that the reason for the decline might be something else and that other areas with similar opportunities could experience decline in motor competence of children aged seven- and eight-year-old. However, with the findings in the present study we cannot say anything about cause and effect. Neither can we generalize the findings for the whole of Norway.

If one proves through research that indeed there was a decline in children's motor skills in the recent years in a large population, then the importance of a research like that will be very highly valued in the eyes of many. Such research could then help understand how children's motor skills have declined with the years. If we compare this with corresponding research and find a declining pattern in motor skills among children, then we could have a say on whether there was a negative development pattern. If that be the case, then research of this sort could be of much importance to many, from a single individual that wishes to help children achieve better motor skills and health, all the way through schools, sports clubs, and politicians up to the high government.

Future research should look more at the factors that affect motor competence the most and look at the connections between these factors and the development of motor competence

and levels of physical activity. More specific, how do these factors affect the motor competence, motor development and physical activity in school aged children, and which factors have a positive effect on development of motor competence in children. Growing up environment, family income, siblings, schools, sports involvement among other factors are some to look deeper at. With a deeper knowledge on these factor relation with motor competence and motor development, we can know more about what measures should be put in place to ensure that the development of the motor skills and the physical skills of children grows in a positive way.

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Appendix 1 (Approval form NSD)

Tommy Haugen
Serviceboks 422
4604 KRISTIANSAND S

Vår dato: 05.01.2018 Vår ref: 57226 / 3 / BGH Deres dato: Deres ref:

Vurdering fra NSD Personvernombudet for forskning § 31

Personvernombudet for forskning viser til meldeskjema mottatt 15.11.2017 for prosjektet:

57226	*Alt var mye bedre før? En sammenlikning av barns grovmotoriske ferdigheter i 1995, 2004 og 2017*
Behandlingsansvarlig	*Universitetet i Agder, ved institusjonens øverste leder*
Daglig ansvarlig	*Tommy Haugen*
Student	*Mohammad Jaber Ali Yousaf*

Vurdering

Etter gjennomgang av opplysningene i meldeskjemaet og øvrig dokumentasjon finner vi at prosjektet er meldepliktig og at personopplysningene som blir samlet inn i dette prosjektet er regulert av personopplysningsloven § 31. På den neste siden er vår vurdering av prosjektopplegget slik det er meldt til oss. Du kan nå gå i gang med å behandle personopplysninger.

Vilkår for vår anbefaling

Vår anbefaling forutsetter at du gjennomfører prosjektet i tråd med:

- opplysningene gitt i meldeskjemaet og øvrig dokumentasjon
- vår prosjektvurdering, se side 2
- eventuell korrespondanse med oss

Vi forutsetter at du ikke innhenter sensitive personopplysninger.

Meld fra hvis du gjør vesentlige endringer i prosjektet

Dersom prosjektet endrer seg, kan det være nødvendig å sende inn endringsmelding. På våre nettsider finner du svar på hvilke endringer du må melde, samt endringsskjema.

Opplysninger om prosjektet blir lagt ut på våre nettsider og i Meldingsarkivet

Vi har lagt ut opplysninger om prosjektet på nettsidene våre. Alle våre institusjoner har også tilgang til egne prosjekter i Meldingsarkivet.

Vi tar kontakt om status for behandling av personopplysninger ved prosjektslutt

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Ved prosjektslutt 15.05.2018 vil vi ta kontakt for å avklare status for behandlingen av personopplysninger.

Se våre nettsider eller ta kontakt dersom du har spørsmål. Vi ønsker lykke til med prosjektet!

Marianne Høgetveit Myhren

Belinda Gloppen Helle

Kontaktperson: Belinda Gloppen Helle tlf: 55 58 28 74 / belinda.helle@nsd.no

Vedlegg: Prosjektvurdering
Kopi: Mohammad Jaber Ali Yousaf, jab.ay19@gmail.com

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 57226

INFORMASJON OG SAMTYKKE

Dere har opplyst i meldeskjema at utvalget vil motta skriftlig informasjon om prosjektet, og samtykke skriftlig til å delta. Vår vurdering er at informasjonsskrivet til utvalget, mottatt på epost 04.01.2018, er godt utformet.

BARN I FORSKNING

Selv om barnets foresatte samtykker til barnets deltakelse i prosjektet, må også barnet gi sin aksept til å delta. Vi anbefaler at barnet mottar tilpasset informasjon om hva deltakelse i prosjektet innebærer. Dere må sørge for at barnet forstår at deltakelse er frivillig, og at det kan trekke seg om det ønsker det.

DATAINNSAMLING

I følge meldeskjemaet vil datainnsamlingen bestå i skoleelever skal gjennomføre en grovmotorisk test bestående av fire deloppgaver:

1.Balansere baklengs på balanseplanker i tre ulike bredder.

2.Hinke over hinder der høyden øker etter hvert.

3.Sidehopp med samlete bein over list.

4.Sideforflytting av brett og seg selv.

INFORMASJONSSIKKERHET

Personvernombudet forutsetter at du/dere behandler alle data i tråd med Universitetet i Agder sine retningslinjer for datahåndtering og informasjonssikkerhet. Vi legger til grunn at bruk av privat pc eller mobil lagringsenhet er i samsvar med institusjonens retningslinjer.

PUBLISERING

I meldeskjemaet har dere krysset av for at dere skal publisere personopplysninger i oppgaven. Dersom personopplysninger skal publiseres, må det innhentes et eksplisitt samtykke til dette. Vi kan imidlertid ikke finne informasjon om dette i informasjonsskrivet. Personvernombudet legger derfor til grunn at dette er feil, og har endret dette punktet til at dere skal publisere anonymt og at ingen informanter vil kunne gjenkjennes i publikasjonen.

PROSJEKTSLUTT OG ANONYMISERING

Prosjektslutt er oppgitt til 15.05.2018. Det fremgår av meldeskjema/informasjonsskriv at du/dere vil anonymisere datamaterialet ved prosjektslutt. Anonymisering innebærer vanligvis å:

- slette direkte identifiserbare opplysninger som navn, fødselsnummer, koblingsnøkkel
- slette eller omskrive/gruppere indirekte identifiserbare opplysninger som bosted/arbeidssted, alder, kjønn

Appendix 2 (Letter of content from guardian)

Forespørsel om deltakelse i forskningsprosjektet

"Alt var mye bedre før?"

Bakgrunn og formål

Man hører stadig gjennom media om nedgangen i barns utholdenhet, styrke og motoriske ferdigheter, og at dette er dårligere enn tidligere.

I en undersøkelse gjort i 1995 ble grovmotorikken til sju- og åtteåringer på Nøtterøy testet. Ut av nysgjerrigheten for å sammenligne barns motoriske ferdigheter gjennom tid ble en lik undersøkelse gjennomført i 2004, og det er nettopp for samme grunn at det ønskes å gjennomføre en ny undersøkelse nå. Det er viktig for studien at det er deltagere (elever) fra samme skolekrets med tilsvarende sosial bakgrunn og tilgang på samme næringsmiljø som i 1995 og 2004. Derfor forespørres vi deltagere fra samme område for denne nye datainnsamlingen.

Målet med en denne studien er å se om det er noen forskjeller i barns grovmotoriske ferdigheter (i Nøtterøy) fra 1995, 2004 og 2018. Den nye undersøkelsen er en mastergrad ved Universitetet i Agder.

Hva innebærer deltakelse i studien?

I denne studien skal vi teste barnas grovmotoriske ferdigheter.

Testbatteriet som vil bli brukt for å teste de grovmotoriske ferdighetene heter Körperkoordinationstest für Kinder, KTK.

Dette er en grovmotorisk test bestående av fire deloppgaver:
1. Balansere baklengs på balanseplanker i tre ulike bredder.
2. Hinke over hinder der høyden øker etter hvert.
3. Sidehopp med samlete bein over list.
4. Sideforflytting av brett og seg selv.

I tillegg til disse testene vil det være ønskelig å spørre elevene om hva de syns om kroppsøvingsfaget.

I publiseringen av dette arbeidet vil alle testpersoner være anonyme.
Datamaterialet blir registrert som notater på en egen passordbeskyttet datamaskin.
I denne studien må foreldrene samtykke for elevene. Ønsker du mer informasjon kan prosjektleder og veileder kontaktes.

Hva skjer med informasjonen om deg?
Alle personopplysninger vil bli behandlet konfidensielt. Kun prosjektgruppen vil ha tilgang til alle personopplysninger og datamateriale (Prosjektansvarlig og veiledere). Alt av innsamlet informasjon vil bli lagret på en egen passordbeskyttet datamaskin som kun prosjektgruppen vil ha tilgang til. Vi trenger ingen personopplysninger utover alder på barna, men skolens geografiske område vil bli nevnt.

Prosjektet skal etter planen avsluttes 15.juli 2019. Alle personopplysninger og datamateriale vil bli anonymisert ved prosjektslutt.

Frivillig deltakelse
Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert.

Dersom du ønsker å delta eller har spørsmål til studien, ta kontakt med:

Prosjektansvarlig (Masterstudent)
Mohammad Jaber Ali Yousaf
E-post: Jab.ay19@gmail.com
Mobil: 98 81 56 48

Veileder:
Tommy Haugen
E-post: Tommy.haugen@uia.no
Telefon: 38 14 23 27
Mobil: 90 20 77 09

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykke til deltakelse i studien

Jeg har mottatt informasjon om studien, og er villig til å la barnet mitt delta

Navn på barnet/eleven: _____

(Signert av prosjektdeltakers foresatt, dato)