

## ARTICLE

### Play smartly – group intervention: changes in parental reports of child behaviour

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## **Play smartly – group intervention: changes in parental reports of child behaviour**

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### **Abstract**

The aim was to study whether a new group intervention for elementary school children with neuropsychiatric challenges and their families, who are worried about the children's digital gaming, changes the children's behaviour. The three-year Play Smartly project started in 2022 (Pelaa Fiksusti, 2025). There were nine groups, each lasting 13 weeks, including in total 43 children and 54 parents from 38 families. Waitlist-design was used, where part of the families just filled the questionnaires in the beginning and the end of a semester, and had the opportunity to participate in the groups during the following semester. Child's strengths and difficulties questionnaire (SDQ) and questionnaire about child's digital gaming, including modified game addiction scale (GAS-7), were used. Data was analysed in SPSS with generalized estimating equations (GEE) analysis. Regarding child's digital gaming behaviour, there was decreasing trend after controlling for reporter's sex and child's age both measured with GAS-7 ( $p=0.002$ ) and with problematic digital gaming scale developed in the project ( $p<0.001$ ). Hyperactivity, conduct problems, peer problems, and total difficulties were lower after the intervention compared to before the intervention (all  $p<0.05$ ). Although the sample size is small, the results are promising and the intervention seems to have positive effects on the children's behaviour.

**Keywords:** digital game playing, elementary school aged children, intervention with waitlist design, SDQ, GAS-7

## **Introduction**

Digital games can be fun and educating, but playing digital games can become problematic, if it takes too much time from other activities. Especially among individuals with neuropsychiatric challenges, such as attention deficit hyperactivity disorder (ADHD) or autism spectrum disorder (ASD) symptoms, the risk for problematic digital gaming may be elevated. During the Covid-19 pandemic remote teaching and learning were a necessity and the usage of digital devices increased. Lately, there has been wide societal discussion and worry about children's usage of digital devices and, for example, how it may disturb the teaching in the classes and pupils' concentration. For this reason, in Finland a new legislation since 2025 restricts the children's usage of digital devices at schools, in a way that pupils can use digital devices during lessons at school only with permission from the teacher for study or health care purposes. There are also some general recommendations or guidelines for elementary school-aged children's usage of digital devices and general well-being, such as the leisure time digital device usage should be limited to maximum of two hours per day, children should have physical activity at least an hour per day, and they should sleep 9 to 11 hours per night (Tremblay et al., 2016).

Although, there has been general considerations and worry about children's digital gaming and usage of digital devices, the studies considering problematic digital gaming in elementary school aged children have been scarce, and group interventions for problematic digital gaming for this age group has been absent in Finland. Elementary school age before puberty is a good developmental phase to intervene the problematic digital gaming behaviour because the children are still reliant on their parents and it may be easier to form family rules and conversations between the parent and the child. Thus, the aim of the present study is to pilot a new group intervention for elementary school children, who have neuropsychiatric challenges, and their families, who are worried about the children's digital gaming, and study whether the children's behaviour changes during the Play Smartly group intervention. This could support social justice, diversity, and inclusivity of the vulnerable children and their families. The Play Smartly group intervention and materials may be especially important in Nordic rural regions where it is cold and dark during the winters and long distances between houses and thus digital gaming may become the main activity for the children and only way to keep contact with peers is online.

Play Smartly was a three-year project (Pelaa Fiksusti, 2025), where the first groups started in fall 2022 and the last groups were organized in fall 2024. During the project there were nine groups including around five families per group, each group lasting 13 weeks. In total 43 children and 54 parents from 38 families have participated in the groups. There were eight simultaneous discussion group sessions for parents and children in separate rooms in Niilo Mäki Institute (NMI), Jyväskylä, Finland. In addition, children had five physical exercise group sessions.

## **Problematic digital gaming**

Digital technologies and playing digital games are part of children's leisure time nowadays. Most of the elementary school aged children in western countries have access to digital devices (Rega, Gioia, and Boursier, 2023), and in Finland almost 45% of children play digital entertainment games every day and almost 80% at least every week (Kinnunen, Prykäri, and Mäyrä, 2024). Playing digital games can be

fun and educating leisure activity, however, if taking too much time from other activities, it may become problematic. In its extreme a gaming disorder may develop. In the 11<sup>th</sup> Revision of the International Classification of Diseases (ICD-11, 2025) gaming disorder is defined “as a pattern of persistent or recurrent gaming behaviour (‘digital gaming’ or ‘video-gaming’), which may be online (i.e., over the internet) or offline, manifested by: 1. impaired control over gaming (e.g., onset, frequency, intensity, duration, termination, context); 2. increasing priority given to gaming to the extent that gaming takes precedence over other life interests and daily activities; and 3. continuation or escalation of gaming despite the occurrence of negative consequences”. The prevalence of gaming disorder is 3%, although there is variability on the prevalence estimates, and it is estimated to be even 6.6% among children and adolescents (Griffiths et al., 2025). Less severe problematic digital gaming, which does not fulfil the criteria for gaming disorder, but may still disturb the wellbeing and everyday life, is even more prevalent. For example, in a Finnish sample of adolescents and young adults the prevalence of problematic gaming measured with Game Addiction Scale (GAS-7) was 9.1% (Männikkö, Billieux, and Kääriäinen, 2015). Problematic digital gaming and screen time has been shown to associate with mental problems, although the causation has not been confirmed and the relationships may also be bidirectional (Girella-Serrano et al., 2024; Paulus et al., 2023).

### **Childhood behaviour problems**

In a large worldwide meta-analysis by Polanczyk, Salum, Sugaya, Caye, and Rohde (2015), the prevalence of children’s and adolescent’s mental disorders was 13.4%. For internalizing disorders, the prevalence of anxiety disorders was 6.5% and for depression disorders 2.6%. Regarding externalizing disorders, the prevalence of ADHD was 3.4%, any disruptive disorder 5.7%, oppositional defiant disorder 3.6%, and conduct disorder 2.1% (Polanczyk et al., 2015). About similar prevalence (e.g. any childhood mental disorder 12.7%) were found in a meta-analysis in high income countries (Barican et al., 2022) and any psychiatric diagnosis in early adulthood 12.4% in males and 12.8% in females in a large cohort study in Finland (Sourander, Kaajalaakso, Vuori, Sillanmäki, and Luntamo, 2025). The Finnish cohort study showed that especially conduct problems and emotional symptoms at eight-years-old were independent predictors of psychiatric diagnosis in early adulthood (Sourander et al., 2025). The Strengths and Difficulties Questionnaire (SDQ) is a well-established measure to screen children’s behaviour problems, such as hyperactivity/inattention, conduct problems, peer problems, and emotional symptoms, showing high correlations with other screening tools, such as Achenbach’s Child Behavior Checklist  $r=0.75$  (Koskelainen, Sourander, and Kaljonen, 2000).

### **Changes in child behaviour in previous intervention studies for problematic digital gaming**

Previously, it has been shown that a school- and cognitive behavioural therapy (CBT)-based preventive intervention (PROTECT) reduced symptoms of gaming disorder or unspecified internet use disorder in 12 to 18 year-old German adolescents more than in an assessment-only control group (Lindenberg, Kindt, and Szász-Janocha, 2022). However, in the secondary outcomes, such as behavioural problems measured with SDQ, the reduction in the intervention group did not differ from the symptom reduction in the control group. In a recent systematic review of effectiveness of therapeutic interventions in the treatment of internet gaming disorder (IGD), CBT was found to be most effective intervention in reducing

IGD symptom severity, anxiety and depression, especially if physical exercise or mindfulness was included in the intervention (Núñez-Rodríguez et al., 2025). Also, inclusion of family members in the intervention increased interpersonal relationships and lowered relapse rates. However, previous studies have included 12 year-olds or older participants, thus intervention studies among elementary school-aged children under 12 years old are mainly missing (Lampropoulou, Siomos, Floros, and Christodoulou, 2022). According to our knowledge, the only intervention study for reducing problematic digital gaming among 8-12 years old children was done by Apisitwasana, Perngparn, and Cottler (2018) in Thailand. They administered an eight week school- and family-based intervention to enhance children's self-regulation skills for digital gaming, and the results showed decreased problematic digital gaming behaviour in the intervention group, but not in the control group (Apisitwasana et al., 2018). Also, a meta-analysis of psychosocial interventions for children's wider internet addiction has been done in Korea, showing CBT- and family-based interventions being effective for decreasing internet addiction (Yeun and Han, 2016). However, the authors recognized a lack of intervention studies for internet addiction or digital gaming addiction in school-aged children in Western countries.

## **Research questions and hypothesis**

The aim of the present study is to fill this gap in research and to study the effectiveness of Play Smartly - group intervention including elementary school-aged children, who have neuropsychiatric symptoms, and their parents, who are worried about their digital gaming behaviour. The main aim was to test whether the parental reports of child problematic digital gaming behaviour (measured with GAS-7 or child problematic digital gaming questionnaire developed in the Play Smartly project) or child behavioural difficulties (measured with SDQ) decreased after participating in the Play Smartly -group intervention. The hypothesis was that there would be positive changes in child behaviour, especially reductions in the problematic digital gaming behaviour following the intervention.

Play Smartly -group intervention combines psychoeducation, discussions, and peer support for both the children and their parents as well as physical exercise for the children. The inclusion of the parents for the intervention and the physical exercise for the children may enhance the treatment effects (Núñez-Rodríguez et al., 2025). Also, the age of the children or the fact that they had neuropsychiatric challenges may enhance wider changes in the children's behaviour beyond the digital gaming. Elementary school aged children before puberty may be more receptive for the intervention and parental guidance, and thus the wider changes in behaviour may be easier to modify than after puberty during adolescence. Also, having behavioural difficulties, e.g. higher score in SDQ, to begin with may allow to see changes in it via the intervention. If the behavioural difficulties were missing or low in the beginning, it would not be possible to reduce them, which may be an explanation to not find wider behavioural changes in e.g. a normative school -based sample.

## **Methods**

### **Study design and sample**

The target group in the Play Smartly -project were elementary school children who play digital games and who have neuropsychiatric challenges, such as ADHD or ASD or learning difficulties, as well as

their parents. No formal diagnosis of neuropsychiatric challenges or gaming addiction was needed; symptoms or challenges were enough for participation. The participants were recruited from Central Finland area via Children’s diagnostic clinic in NMI, schools as well as ADHD association, ASD association and parents’ association. Recruiting of families started in August 2022 and five families were selected to the first pilot group in fall 2022 and ten families to a waitlist-control group. Waitlist-control group completed only the questionnaires in the beginning and end of the semester, and for them a place in Play Smartly -group was offered in the next semester. Participants were asked to complete the questionnaires one to three times before participating in the group sessions and one to three times after the group sessions, thus there was a maximum of six measurement points per participant. New groups started every semester until the end of 2024. Study design of the data collection is presented in Table 1. Participation in research and group activities was voluntary. All the participants were informed about the study and gave their consent to participate. Each family got one movie ticket when participating in the first interview. Parents completed the questionnaires first in paper and since beginning of 2023 electronically. Children were interviewed and the interviewer completed their questionnaires. After the group, feedback from the participants was also asked for.

Table 1: the design of the data collection

From fall 2022 until spring 2025 (aim: 45 families participate to the intervention)														
<b>Intervention 1 (5 families)</b>														
1 <sup>a</sup>	2	3	4											
O <sup>b</sup>	X	O	-	O	V	O								
<b>Control 1 (10 families) who participate to intervention in the second phase</b>														
1	2	3	4	5	6									
O	-	O	-	O	X	O	-	O	V	O				
<b>Control 2 (10 families) who participate to intervention in the third phase</b>														
		3	4	5	6	7	8							
		O	-	O	-	O	X	O	-	O	V	O		
<b>Control 3 (10 families) who participate to intervention in the fourth phase</b>														
				5	6	7	8	9	10					
				O	-	O	-	O	X	O	-	O	V	O
<b>Control 4 (10 families) who participate to intervention in the fifth phase</b>														
						7	8	9	10	11				
						O	-	O	-	O	X	O	-	O

<sup>a)</sup> Measurement point's number: 1 = Fall 2022, 2= December 2022, 3 = February 2023, 4 = May 2023, 5 = Fall 2023, 6 = December 2023, 7 = February 2024, 8 = May 2024, 9 = Fall 2024, 10 = December 2024, 11= February 2025)

<sup>b)</sup> Waitlist-control design: O = measurement, X = group intervention, - = no intervention, V = peer support group

During the whole project there have been nine groups with approximately five families in each group. In total 43 children and 54 parents from 38 families have participated in the groups. Drop-out rate was 14%. Six children and seven parents dropped out from the groups, usually at the beginning of the group. Mainly the reasons were that they did not feel the group suitable for them or they had too many other burdens. The participating parents were mostly mothers (67%). Parents’ mean age was 42 years and their median education was bachelor’s degree and median of families’ income was 40,000 – 69,999€. The participating children were 6 – 12 years old and mainly boys (over 90%), who had ADHD symptoms (73%), autism spectrum traits (53%) and/or learning difficulties (27%), where combinations of these

symptoms were possible. The parents reporting these challenges was enough for participation, thus we did not require diagnoses.

### **Details of Play Smartly -group intervention**

During the semester the group activities included eight meetings in NMI Jyväskylä, which lasted 90 minutes. These meetings were held simultaneously for parents and children, but in separate rooms. In addition, there were five special physical exercise group sessions for children overlapping the discussion group meetings during the semester. The physical exercise group sessions were shorter, lasting 75 minutes, and in them children had possibilities of testing different forms of exercise, e.g. trampoline park, laser-tag, ball games etc. Parents' groups included presentations from professional experts as well as experts by experience in addition to discussions and peer support. In the children's groups, the participants e.g. played board and card games, made handicrafts and designed and made their own board game in addition to the discussions on the topics. The topics of the group meetings were: becoming acquainted and generally about digital games, digital game education and safe media usage, own resources and wellbeing, digital games and social relationships, emotions and digital games, family rules and everyday structure, supporting the child's self-regulation and on the last session feedback was requested by pen and paper and in group discussion, after which the board game the children had made was played together. In the children groups different trivia quizzes and motivating exercises were used to facilitate the discussion. More detailed framework of the group sessions can be found in Table 2. The families who participated in the Play Smartly -groups had also a possibility to continue during the following semester in a peer support group which consisted of five discussion group sessions for children and parents separately, as well as five physical exercise sessions for the children.

### **Measures**

The Game Addiction Scale (GAS-7) is a short seven item questionnaire to measure gaming addiction (Lemmens, Valkenburg, and Peter, 2009). The seven items cover salience, tolerance, mood modification, relapse, withdrawal, conflict and problems, and were scored on a scale 1 (never) to 5 (very often) during the last six months. The scale was modified from the original self-report version for adolescents to an informant-report version for the parents to complete regarding the child's gaming behaviour. Cronbach's alpha for the GAS-7 scale was 0.74. The scale can be used either as a raw sum score of the responses for the items, the sum score ranging from 7 to 35, or the score of 3 (sometimes) can be used as a cut-off score, giving a point for each item scored 3 or more, thus the point sum score ranging from 0 to 7. Then four points or more is considered problematic gaming and seven points as pathological gaming. The Finnish version of GAS-7 has been tested by Männikkö, Billieux and Kääriäinen (2015), showing a prevalence of 9.1% of problematic gaming among Finnish adolescents and young adults. However, no previous study has been done in Finland with GAS-7 for elementary school-aged children where their parents have answered to GAS-7 regarding their child.

Table 2: Framework of Play Smartly - intervention groups

	Parents	Children
Info	Introduction of the project and group activities	Individual interviews, getting to know others
1st session Getting to know each other and digital games	Rules of the group, getting to know each other, generally about digital games, age limits, Activity pass	Rules of the group, getting to know each other, starting to design the group's own board game: game figures
2nd session Me as a player/game educator	About digital games and game education, what kind of game educator am I, Agreement of digital game playing	What kind of player am I, why digital game playing is important to me, designing the group's own board game: game board
3rd session Digital games and well-being	Taking care of one's own well-being, factors increasing one's resources, relaxation exercise	Taking care of one's own well-being, quiz about well-being recommendations, the circle of the day, relaxation exercise
4th Digital games and social relationships	The effects of digital gaming on social relationships, how to support the child's social relationships, internet etiquette, cyberbullying	The effects of digital gaming on social relationships, how to behave smartly in digital games, internet etiquette, cyberbullying, designing the own board game: the rules of the game
5th Digital gaming and emotions, emotion regulation	About emotions, what kind of emotions or feelings are associated with gaming or stopping gaming, supporting a child's emotional skills, encountering an angry person, constructive expression of anger	Traffic light model of emotions, what to do when a difficult feeling comes, relaxation exercise, designing the own board game: obstacles and surprises
6th session Digital gaming and everyday structure	Wellness recommendations, day and week structure, the child's circle of the day, alternative leisure activities	Things that are important to me, ranking list, alternative leisure activities, continuing the designing the group's own board game
Two weeks break, individual videocalls for families	In the videocall: What rules did you choose in the Agreement of digital game playing? How its compliance has gone? Successes, challenges? How the child has done in the group? Encouraging home practice	
7th session Supporting the child's self-regulation / what else can you do with a digital device other than play	Supporting self-regulation in child, through the positive, rewarding, concrete positive feedback, if-then -plans to achieve goals (WOOP)	Reading moment with an adult, what else can you do with a digital device other than play, information search, finishing the group's own board game
8th session Feedback, playing together the board game	Feedback in the form of questionnaires and group discussions, playing the children's own board game together	Individual interviews, playing the children's own board game together
Duration of a session is 90 minutes.		
In addition, children have five physical exercise sessions in between these discussion group sessions.		

The child's problematic digital gaming scale is a 10-item questionnaire developed in the Play Smartly - project. Parents scored the ten items on a scale 1 (never) to 5 (always/daily), and a mean score was calculated. Mean score of 3.1 or more is considered problematic gaming. This cut-off score is based on a mean + one standard deviation of a larger sample (n = 165) collected from parents of elementary school aged children in Central Finland. The larger sample was used to shorten the original 30-item questionnaire to 10 items e.g. with factor analyses. Cronbach's alpha for the scale was 0.77. The items are: "I think my child can control his/her gaming." (reverse coded), "If my child may choose between gaming or some other leisure activity (friends, physical exercise, hobby, excursion, movie, etc.), (s)he chooses gaming.", "Quarrels arise in our family because of the child's gaming.", "My child reacts

aggressively when (s)he has to quit a gaming session.”, “My child becomes restless or depressed when (s)he doesn’t get to play games.”, “My child uses every possible opportunity to play games.”, “My child reacts negatively (gets nervous, upset, etc.) when I set gaming restrictions for him/her.”, “I am worried about my child’s gaming.”, “It’s hard for my child to find something else to do other than playing games.”, and “My child is asking for more gaming time.”

The Strengths and Difficulties Questionnaire (SDQ) is a 25-item questionnaire consisting of five scales of hyperactivity/inattention difficulties (Cronbach’s alpha = 0.76), conduct problems (Cronbach’s alpha = 0.49), emotional symptoms (Cronbach’s alpha = 0.79), peer problems (Cronbach’s alpha = 0.67) and prosocial behaviour (Cronbach’s alpha = 0.71), each including five items scored 0 to 2 points (Goodman, 1997). Total difficulties sum score can be calculated by summing up all the other scales excluding prosocial behaviour (Cronbach’s alpha = 0.78). Each scale has a possible range from 0 to 10 and the total difficulties sum score range from 0 to 40. SDQ has been shown to have adequate internal consistency and validity among Finnish school-aged children (Koskelainen, Sourander, and Kaljonen, 2000).

### **Statistical analyses**

Descriptive statistics, i.e. means and standard deviations of the main variables, were calculated, and bivariate associations between the variables were analysed using Spearman correlations. Generalized estimating equations (GEE) analysis with normal link function was used to utilize all the six measurement points to see when exactly the change in the child behaviour happened. Reporter’s sex and child’s age were used as covariates in the GEE analysis, and statistical significance was set as  $p < 0.05$ . No adjustments for multiple comparisons were applied. To adjust the statistical significance for multiple comparisons Bonferroni corrected p-value would be  $0.05/9 = 0.006$ . However, Bonferroni correction has also been criticized for being overly conservative, especially with small sample sizes (VanderWheele and Mathur, 2019). Missing data was not imputed, rather it was analysed as reported, thus cases with missing data on dependent variables or covariates were excluded. We have no reason to expect that either the covariates, i.e. reporter’s sex or child’s age, nor the dependent variables were associated with the attrition, i.e. the missing data. In addition, the data was also analysed with Quade nonparametric analysis of covariance (ANCOVA) to ensure that the results would not be biased due to the small sample size. Nonparametric tests are generally more robust to assumption violations but tend to have lower statistical power compared to parametric tests when assumptions are met (Conover and Iman, 1981), thus as being more conservative they may lack sensitivity to detect effects. Statistical analyses were done with SPSS 30.

### **Results**

As shown in Table 3, the prevalence of child’s problematic digital gaming measured with the 10-item mean scale developed in the Play Smartly-project was 84.1% just before the intervention, when the cut-off score of 3.1 or more was used, and 58.6% right after the intervention. Thus, the prevalence decreased 25.5 percent units or 30%. The similar prevalence of child’s problematic digital gaming measured with GAS-7 was 80% just before the intervention and 66.7% right after the intervention,

showing a decrease of 13.3 percent units or 13%. Just before the intervention, the prevalence of child's total difficulties measured with SDQ was 70.3% (when cut-off score of 14 or more was used) and 54.1% (when cut-off score of 17 or more was used), and right after the intervention the prevalence was 57.1% and 32.1%, respectively. Thus, the decrease was 13.2 percent units or 19%, when cut-off score was 14 or more, and 22 percent units or 41%, when cut-off point was 17 or more.

Table 3: The prevalences of children's behaviour problems just before the intervention (T1) and right after the intervention (T2)

	T1 <sup>a</sup> %	T2 <sup>b</sup> %	Change T1-T2 % units	Change T1-T2 %
<b>Problematic digital gaming 10-item mean cut-off &gt;= 3.1</b>	84.1	58.6	25.5	30
<b>GAS7 point sum cut-off &gt;= 4</b>	80.0	66.7	13.3	13
<b>SDQ total problems sum cut-off &gt;= 14</b>	70.3	57.1	13.2	19
<b>SDQ total problems sum cut-off &gt;= 17</b>	54.1	32.1	22.0	41
<sup>a</sup> T1 = just before the intervention				
<sup>b</sup> T2 = right after the intervention				

Table 4 shows the means, standard deviations and bivariate correlations between the main variables and covariates (i.e. child's age and parent's sex) in the measurement point just before the intervention. Higher child's age correlated with more peer problems. Mothers reported more problematic digital gaming in the child both with the 10-item mean scale and GAS-7 scale. Parental reports of higher child's problematic digital gaming correlated with more conduct problems, peer problems, emotional symptoms and total problems measured with SDQ. Child's higher hyperactivity was related to more conduct problems and total problems. Child's higher conduct problems as well as higher peer problems were associated with more emotional symptoms and total problems measured with SDQ. Child's higher emotional symptoms correlated with total problems measured with SDQ.

Table 4: The bivariate correlations (Spearman) of the variables just before the group intervention (n = 35-52)

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Child's age (n=50)	9.98	1.30										
2. Reporter's sex (1=female, 0=male; n=52)	0.67	0.47	-.03									
3. GAS7_point_sum (n=35)	5.03	1.74	.28	.52**								
4. GAS7_sum (n=35)	21.54	4.33	.16	.54***	.86***							
5. Problematic digital gaming 10-item mean (n=44)	3.51	0.49	.06	.37*	.62***	.84***						
6. SDQ_hyperactivity (n=37)	6.51	2.40	-.31	.29	.26	.25	.16					
7. SDQ_conduct problems (n=37)	3.00	1.73	-.04	.15	.41*	.44*	.39*	.34*				
8. SDQ_peer problems (n=37)	4.32	2.35	.57***	.25	.42*	.23	.06	-.01	.14			
9. SDQ_emotional symptoms (n=37)	3.08	2.45	.03	.11	.37*	.34	.40**	.02	.46**	.38*		
10. SDQ_prosocial behavior (n=37)	5.54	1.99	-.13	.06	.09	.08	-.02	.09	-.05	-.15	.13	
11. SDQ_total problems (n=37)	16.92	5.87	.12	.31	.54**	.49**	.40*	.47**	.70***	.63***	.73***	.02

\*\*\* p<.001; \*\* p<.01; \* p<.05

### Changes in parental reports of child's problematic behaviour

As shown in Figure 1, GAS-7 point sum is lower after the intervention compared to before the intervention (working correlation matrix structure = Independent, QIC = 509.872, Wald chi<sup>2</sup> = 16.343 (df = 5), p = .006), implying that child's problematic digital gaming decreased during the intervention. Similar trend was found for GAS-7 raw score sum, GAS-7 raw score sum is lower after the intervention compared to before the intervention (working correlation matrix structure = Independent, QIC = 3447.368, Wald chi<sup>2</sup> = 19.553 (df = 5), p = .002). Similarly, problematic digital gaming 10-item scale mean is lower after the intervention compared to before the intervention (working correlation matrix structure = AR(1), QIC = 71.090, Wald chi<sup>2</sup> = 20.744 (df = 5), p < .001), as shown in Figure 2. The

results were similar also when analysed with Quade nonparametric analysis of covariance: for GAS-7 point sum ( $F = 3.198$  ( $df = 5, 147$ ),  $p = .009$ ), GAS-7 raw score sum ( $F = 3.722$  ( $df = 5, 147$ ),  $p = .003$ ), and problematic digital gaming 10-item mean ( $F = 3.955$  ( $df = 5, 185$ ),  $p = .002$ ).

Figure 1: GAS-7 point sum in different measurement points adjusted for reporter's sex and child's age. GEE analysis with working correlation matrix structure: Independent.  $N = 58$  individuals with 1-6 answers per individual and 153 answers in total. Goodness of fit value  $QIC = 509.872$

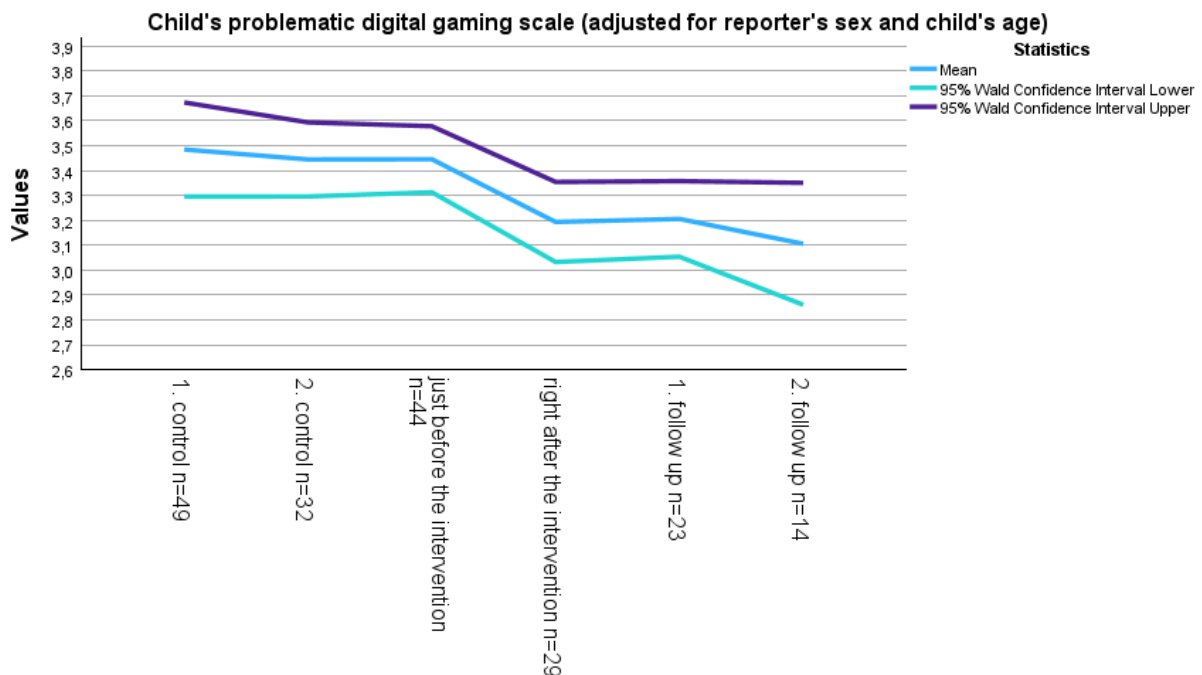
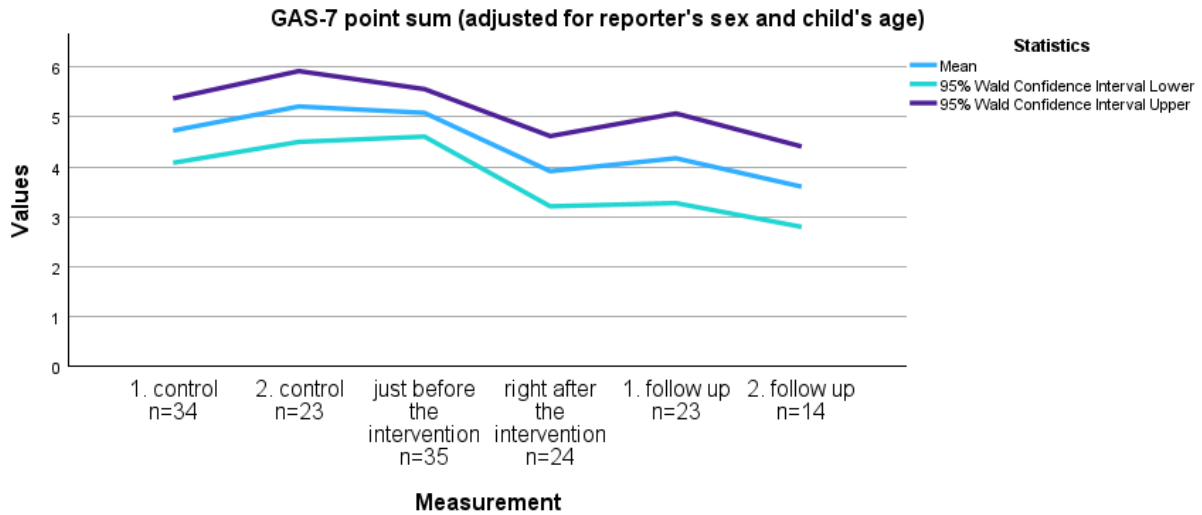


Figure 2: Child's problematic digital gaming 10-item scale mean scored in different measurement points adjusted for reporter's sex and child's age. GEE analysis with working correlation matrix structure: AR(1).  $N = 66$  individuals with 1-6 answers per individual and 191 answers in total. Goodness of fit value  $QIC = 71.090$

The trends in child's difficulties measured with SDQ are shown in figures 3, 4, 5, and 6. In Figure 3, the trend for child's hyperactivity in different measurement points is shown (working correlation matrix structure = Independent,  $QIC = 759.317$ ,  $Wald\ chi^2 = 11.185$  ( $df = 5$ ),  $p = .048$ ). Hyperactivity decreases during the intervention however; it is again on a higher level on first follow up. When analysed with

Quade nonparametric ANCOVA, the change in child's hyperactivity does not be statistically significant ( $F = 1.092$  ( $df = 5, 162$ ),  $p = .367$ ), thus the GEE analyses may be biased because of the small sample size or the Quade analyses may lack sensitivity. In Figure 4, child's conduct problems decrease during the intervention and stay afterwards at lower level compared to their level before the intervention (working correlation matrix structure = Independent,  $QIC = 497.966$ ,  $Wald\ chi^2 = 16.670$  ( $df = 5$ ),  $p = .005$ ). The decrease in child's conduct problems was statistically significant also when analysed with Quade nonparametric ANCOVA ( $F = 2.657$  ( $df = 5, 162$ ),  $p = .024$ ) increasing the robustness of the finding. In Figure 5, the trend for child's peer problems is shown (working correlation matrix structure = Independent,  $QIC = 753.056$ ,  $Wald\ chi^2 = 11.814$  ( $df = 5$ ),  $p = .037$ ). However, there were no changes in child's peer problems, when analysed with Quade nonparametric ANCOVA ( $F = 0.615$  ( $df = 5, 162$ ),  $p = .689$ ), thus this may have been a biased finding in GEE due to the small sample size or the Quade analyses may lack sensitivity. In Figure 6, the trend for child's total difficulties reported by parents with SDQ is shown (working correlation matrix structure = Independent,  $QIC = 4257.427$ ,  $Wald\ chi^2 = 18.904$  ( $df = 5$ ),  $p = .002$ ). The mean of parental reports of child's total difficulties sum score was over 16 points before the intervention, however, it decreased to 14 points right after the intervention and 13 points in the second follow up. In total difficulties, the cut-off points are 13 points or lower (normal range), 14 to 16 (borderline) and 17 or higher (high score). However, when analysing child's total difficulties with Quade nonparametric ANCOVA, the overall trend did not reach statistical significance ( $F = 2.125$  ( $df = 5, 162$ ),  $p = .065$ ), although on the pairwise comparisons the total difficulties were at lower level on right after the intervention ( $p = .030$ ) and on the second follow-up after intervention ( $p = 0.010$ ) when compared to the measurement just before the intervention. There were no statistically significant changes in child's emotional problems nor prosocial behaviour between the measurement points neither when analysed with GEE ( $Wald\ chi^2 = 9.759$  ( $df = 5$ ),  $p = .082$  and  $Wald\ chi^2 = 3.700$  ( $df = 5$ ),  $p = .593$ , respectively) nor with Quade nonparametric ANCOVA ( $F = 0.744$  ( $df = 5, 162$ ),  $p = .592$  and  $F = 0.384$  ( $df = 5, 162$ ),  $p = .859$ , respectively).

Based on the feedback collected from the parents after the intervention, participants were mostly satisfied with the groups (mean was 4.25 on a 7-item Likert-scale with a range of 1 to 5). Parents also found the group activities acceptable, mean was 5.15 on an 8-item modified Abbreviated Acceptability Rating Profile (AARP; Tarnowski and Simenian, 1992), where a maximum value is six.

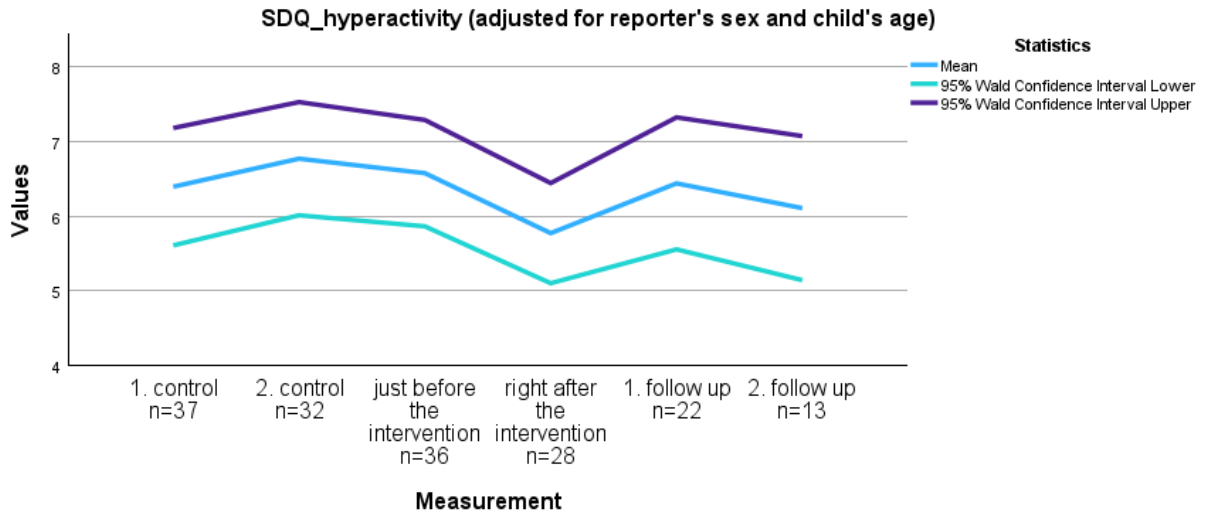


Figure 3: SDQ hyperactivity sum in different measurement points adjusted for reporter's sex and child's age. GEE analysis with working correlation matrix structure: Independent.  $N = 54$  individuals with 1-6 answers per individual and 168 answers in total. Goodness of fit value  $QIC = 759.317$

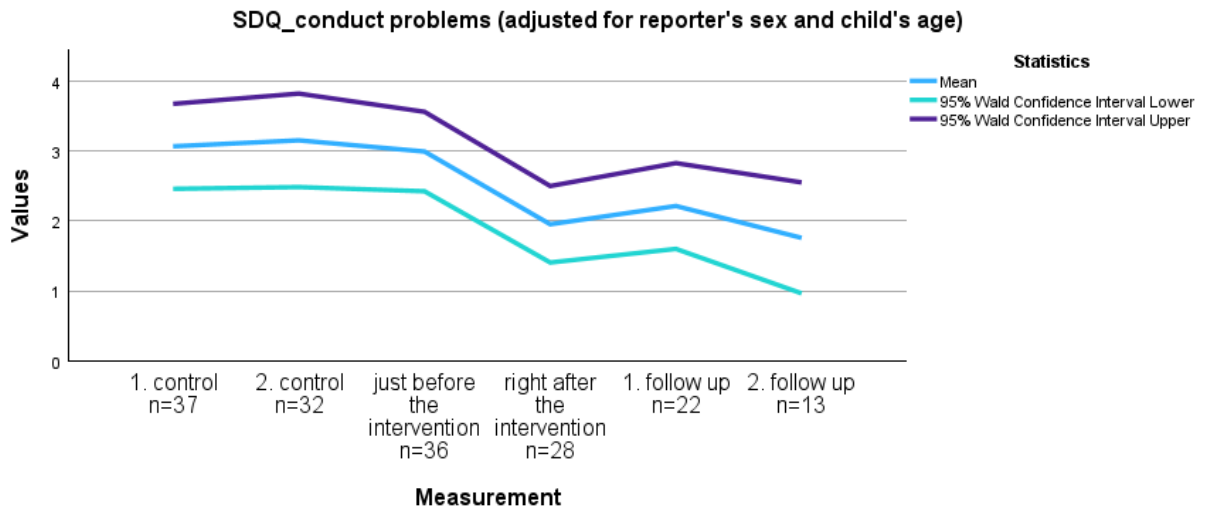


Figure 4: SDQ conduct problems sum in different measurement points adjusted for reporter's sex and child's age. GEE analysis with working correlation matrix structure: Independent.  $N = 54$  individuals with 1-6 answers per individual and 168 answers in total. Goodness of fit value  $QIC = 497.966$

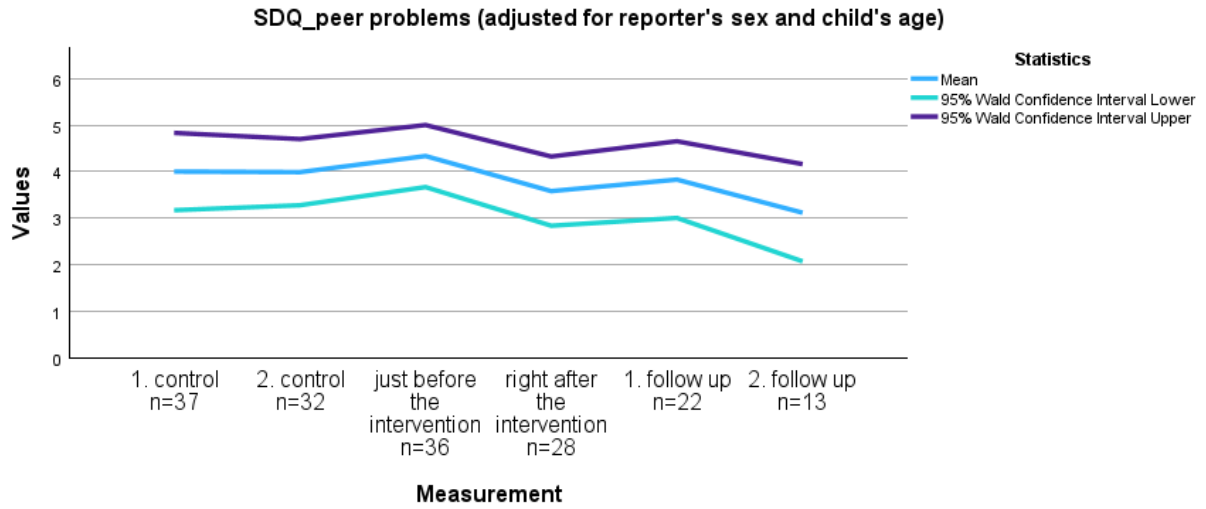


Figure 5: SDQ peer problems sum in different measurement points adjusted for reporter's sex and child's age. GEE analysis with working correlation matrix structure: Independent.  $N = 54$  individuals with 1-6 answers per individual and 168 answers in total. Goodness of fit value  $QIC = 753.056$

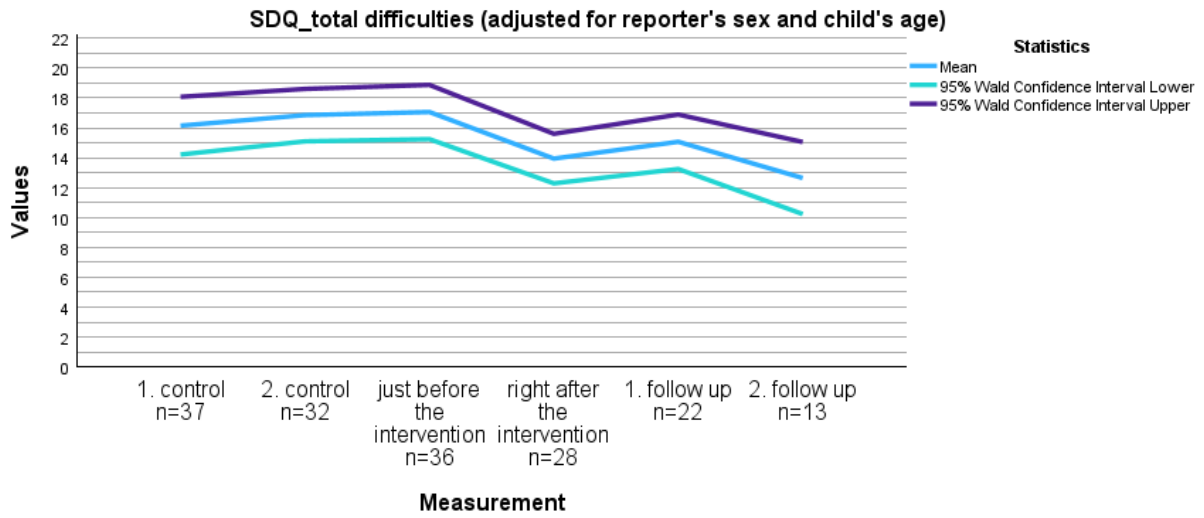


Figure 6: SDQ total difficulties sum in different measurement points adjusted for reporter's sex and child's age. GEE analysis with working correlation matrix structure: Independent.  $N = 54$  individuals with 1-6 answers per individual and 168 answers in total. Goodness of fit value  $QIC = 4257.427$

## Discussion

The current study presents a new group intervention for elementary school children, who have neuropsychiatric challenges, e.g. ADHD or ASD symptoms, and their parents, who are worried about the child's digital game playing. There was moderate to strong correlation ( $r$ 's=.62-.84) between the different children's problematic digital gaming measures, i.e. GAS-7 and the 10-item child's problematic digital gaming scale developed in the Play Smartly -project, meaning that their shared variance was 71%. Children's problematic digital gaming measures also correlated moderately with child's total difficulties measured with SDQ ( $r$ 's=.40-.54). All the subscales of SDQ difficulties had moderate to strong correlations ( $r$ 's=.47-.73) with SDQ total difficulties, while having weak to moderate correlations with child's problematic digital gaming measures ( $r$ 's=.06-.44). Thus, the different measures are related, all measuring child's problematic behaviour, but still distinct, measuring different aspects of child's difficulties. Child's age and reporter's (i.e. parent's) sex correlated mainly weakly or moderately with the main variables (i.e. child's problematic behaviours) and were thus controlled in the subsequent analyses.

As hypothesized, the children's problematic digital gaming reported by parents decreased after the intervention and stayed at the lower level in the follow up measurement points. This decreasing trend was found both with the GAS-7 scale and the child's problematic digital gaming scale developed in the Play Smartly -project. The GAS-7 point sum score of four or above is considered problematic digital gaming and seven points is considered pathological digital gaming. The mean point sum score measured with GAS-7 was five before the intervention, while decreasing to four points after the intervention. The mean score on the 10-item child's problematic digital gaming scale was above 3.4 before the intervention, dropping to 3.2 right after the intervention and decreasing to 3.1 in the second follow up. The mean score of 3.1 is considered the cut-off point in this measure for problematic digital gaming. Thus, the parental reports of children's problematic digital gaming decreased during the intervention and the decrease was stable, although the children's gaming was still in the lower level of problematic digital gaming and needs still parental consideration. These results are in line with previous research showing decrease in elementary school-aged children's problematic digital gaming after family-based interventions (Apsitwasana et al., 2018; Yeun and Han, 2016). However, the previous studies have been mainly done in Asia, thus the present study shows promising results of Play Smartly -group intervention that includes psychoeducation and peer support for the children and their parents for decreasing children's problematic digital gaming in Finland.

In addition, when considering the change in the prevalence of child's problematic digital gaming, it decreased 25.5 percent units or 30% from measurement point just before the intervention to measurement point right after the intervention, when measured with the 10-item mean scale developed in the Play Smartly project. The similar decrease on the prevalence of child's problematic digital gaming measured with GAS-7 was 13.3 percent units or 13%. However, the prevalence of child's problematic digital gaming among the group participants was 66.7% still after the intervention, much higher than in general population of Finnish adolescents, where it has been shown to be 9.1% (Männikkö et al., 2015).

Also, children's behavioural difficulties measured with the SDQ questionnaire decreased after the intervention. Before the intervention the mean of the parental reports of the children's total difficulties score was above 16 points, while right after the intervention the mean dropped to 14 points, and in the second follow up it was 13 points, which already is considered to be in a normal range however, especially among young Finnish children, the suggested cut off may be as low as 10 points for borderline and 12 points for high scores (Borg, Kaukonen, Joukamaa, and Tamminen, 2014). Regarding the subscales, hyperactivity score was above six before the intervention and dropping just below six right after the intervention and increasing again above six points in the follow up measurement points. Six is considered a borderline score in parental reports of child's hyperactivity, while scores seven or higher are considered high score and five or lower are considered to be in normal range. The participants for the study were selected based on having ADHD symptoms, autism spectrum traits or learning difficulties, and most of the participating children (73%) had ADHD symptoms, which may partly explain the high score in hyperactivity. ADHD is relatively persistent and it may be that a longer intervention would be needed for reducing the hyperactivity scores. For peer problems and conduct problems the decrease was more stable. For peer problems the score was above four before the intervention, while dropping below four right after the intervention and being almost three in the second follow up. For SDQ peer problems, score of four or higher is considered high, and three is borderline score, while score two or lower is in normal range. For conduct problems, the score was above three, which is a borderline score, before the intervention and dropped to two points, which is in the normal range, after the intervention and stayed at around two points in the follow up measurement points. Of the children's behaviour problems measured with SDQ, the decrease of conduct problems was the most robust finding, and it may have long-lasting significance, as childhood conduct problems especially have been linked with later risk of serious disorders, e.g. psychotic disorders and substance abuse disorders (Sourander et al., 2025). Regarding emotional problems, no changes were found during the intervention. One possible reason for this may be that the mean score for emotional problems was already at the normal range before the intervention. For SDQ emotional problems, a score of three or lower is in normal range and four is borderline, while five or higher is considered high. In previous intervention research for reducing problematic gaming, the reduction on behavioural symptoms measured with SDQ on the intervention group did not differ from the control group (Linderberg et al., 2022). However, it should be kept in mind that in the PROTECT intervention study, the participants were 12 to 18 years-old adolescents and it was school-based study, while in the present study, the participants were 6 to 12 years-old children with neuropsychiatric challenges and their parents reported the child's behaviour.

### **Strengths and limitations**

This is one of the few studies considering problematic digital gaming in elementary school aged children and according to our knowledge first one in Finland testing a group intervention for problematic digital gaming on this age group. Most of the previous studies regarding problematic digital gaming have been considering adolescents or adults. Elementary school age before puberty is a good developmental phase to intervene the problematic digital gaming behaviour because the children are still reliant on

their parents and it may be easier to form family rules and conversations between the parent and the child.

The sample size was quite small which may limit the generalizability of the results, and the group intervention model should be replicated with a bigger sample size and different target groups, e.g. among neurotypical children. The parental report of their child's neuropsychiatric challenges was enough for the participation to the study thus diagnoses was not required. The problematic digital gaming questionnaires used have not been tested before on this age group. GAS-7 was developed for adolescents and the 10-item problematic digital gaming scale was developed in this project; thus, they should be tested on larger samples of elementary school aged children. There may have been selection bias (e.g., participation by more motivated families) as well as the study lack of long-term follow-up, which limits the ability to assess the sustainability of the results. In addition, children were mostly boys, which limits the generalizability of the results to girls.

## **Conclusions**

The Play Smartly group intervention model seems to be a promising intervention for elementary school aged children, who have neuropsychiatric symptoms, and whose parents are worried about the children's problematic digital gaming. The study showed reductions on the children's problematic digital gaming as well as other problematic behaviour, such as conduct problems, peer problems and hyperactivity. The intervention shows positive changes in the children's behaviour. Thus, it supports social justice, diversity, and inclusivity of the vulnerable children and their families. Play Smartly group intervention and materials may be especially important in northern rural areas where digital gaming may be an easy recreational activity when winters are cold and dark and there are long distances between the neighbours. In future, other parties, e.g. in educational settings in the Arctic, may carry out similar groups or process the topic in other ways with vulnerable children and/or their parents with the help of materials that can be found in Finnish on the Play Smartly project's website (<https://pelaafiksusti.nmi.fi/>). It would be important to study whether Play Smartly group intervention would be scalable as a school-based intervention reaching wider groups and increasing its' cost-effectiveness.

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