



JÖNKÖPING UNIVERSITY

*School of Education and
Communication*

Interventions to improve the en- gagement of children with Attention Deficit/Hyperactivity Disorder in school activities

A Systematic Review

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ABSTRACT

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Attention Deficit/Hyperactivity Disorder (ADHD) is a developmental disorder diagnosed from an early age of life by the symptoms of inattention, hyperactivity and impulsivity. This systematic review aims to explore the evidence for interventions implemented at school by school staff to improve the engagement of children with ADHD in school activities. Six articles were extracted from four different databases (ERIC, PsycINFO, CINAHL and ProQuest Central), after specific inclusion and exclusion criteria had been applied and a quality appraisal procedure implemented and ranked using the Oxford Levels of Evidence Based Medicine. A content analysis was used for the data analysis by categorising relevant findings. Results describe the definitions found in the included in the systematic studies for the term "engagement", the effects of the intervention strategies on the engagement of children with ADHD as well as the types of intervention strategies described in the studies. Effective interventions need to be implemented within the school environment for children with ADHD in order to improve their engagement and social skills. Further research should focus on more intervention strategies implemented at school for improving the engagement of children with ADHD, considering characteristics among different cultures as well.

Keywords: children, Attention Deficit/Hyperactivity Disorder, engagement, interventions, school

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I Introduction

According to the United Nations Convention on the Rights of the Child (1989), all children should have equal education opportunities (Article 28) and equal value in society whether they are in need of special support or not. Children in need of special support can be defined as children with any kind of disability or difficulty, such as physical, intellectual or mental impairment, who need extra support (Convention on the Rights of Persons with Disability, 2006).

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common developmental disorders people face nowadays and it can be identified by the symptoms of inattention, impulsivity and hyperactivity from an early age (DuPaul & Kern, 2011). Children with ADHD face several difficulties that have an impact on their academic performance and social skills. In the past years, children with ADHD used to leave school due to their low academic performance and poor engagement and to the lack of extra support for their difficulties (McConaught et al, 2011). Nowadays, effective interventions are designed for improving children's everyday functioning within the home and school environment.

The present study focuses on intervention programmes which are implemented through several intervention strategies that aim to improve the engagement of children with ADHD in school activities.

2 Background

2.1 Attention Deficit/Hyperactivity Disorder

Attention Deficit/Hyperactivity Disorder (ADHD) is a developmental chronic disorder, which can be identified from the early years of life of children by the symptoms of persistent inattention, hyperactivity and impulsivity (DuPaul & Kern, 2011). The symptoms of ADHD vary from child to child. Moreover, there is no agreement in scientific literature about the nature and the causation of ADHD (Heward, 2009).

The formal diagnosis for ADHD can be made according to the Diagnostic and Statistical Manual of Mental Disorders-4th edition (DSM-IV; American Psychiatric Association (APA) 1994), and more recently to the fifth edition (DSM-V; APA, 2013). The DSM-IV lists 18 symptoms that consist of the main characteristics of ADHD: 9 symptoms of inattention and 9 symptoms of impulsivity and hyperactivity (McConaught, Volpe, Antshel, Gordon, Eiraldi, 2011). According to the DSM criteria, there are three types of ADHD: a) the *ADHD-Predominantly Inattentive type*, when the patient should meet 6 or more of the 9 symptoms of inattention, b) *ADHD Predominantly Hyperactive-Impulsive type*, when the patient should meet 6 or more of the 9 symptoms of hyperactivity and impulsivity c) *ADHD-Combined type*, when the patient has a combination of the previous types (APA, 1994). Moreover, the symptoms should be present in two or more settings, such as home and school. Many studies differentiate children with ADHD depending on the subtype they have in their diagnosis (Loe & Feldman, 2007).

Although the symptoms and the domains of ADHD have remained the same as in the DSM-IV (APA, 1994), there are several changes in the updated DSM-V (APA, 2013). Such changes are the addition of examples to the criterion items, the change on the onset criterion from “symptoms and impairment before age 7” to “symptoms and impairment before age 12”, the replacement of the DSM-IV subtypes with presentation specifiers to map the prior subtypes, the allowance of the diagnosis with Autism Spectrum Disorder and the symptom threshold change for adults (Epstein & Loren, 2013). In this systematic review the focus was on inclusion of articles which used the DSM-IV, as it was anticipated that fewer intervention publications will be available in

which the diagnostic criteria of DSM-V have been applied, due to the recent year of publication.

Most times children with ADHD have poor academic performance and experience difficulties in their social skills, in comparison to their typically developing classmates (McConaught et al, 2011). More specifically, children with ADHD tend to be more aggressive, have difficulties in focusing on a task that needs to be implemented and in controlling their movements, and confronting behavioural problems. This could explain why children with ADHD usually achieve low academic performance and restricted participation in activities and interaction with their peers. Also, children with ADHD are at higher risk for accidental injuries, due to their impulsive and risky behaviour functions (DuPaul & Kern, 2011). Last but not least, it is particularly important for an early diagnostic assessment for ADHD in order that effective interventions can be implemented at home and school settings so that the child's everyday functioning is enhanced at earliest possible point (DuPaul & Kern, 2011).

2.2 Engagement

Lately, many studies have turned their interest to *engagement*. According to the *American Oxford Dictionary* the verb "to engage" is defined as "to attract and keep someone's attention and interest". The term engagement started being used in educational and academic literature in order to explain the reasons of boredom and students' dropping out of schools (McFerran, Crooke & Bolger, 2017). The term engagement is a multidimensional construct and the definitions can vary between the different authors (Imms et al., 2016). In literature, engagement is defined in three ways: as behavioural engagement, emotional engagement and cognitive engagement (Fredricks, Blumenfold & Paris, 2004).

Within the classroom, behavioural engagement includes the meaning of adherence to the classroom rules, involvement and participation in academic activities and behaviours related to concentration, persistence and attention (Fredricks et al., 2004). Additionally, the term participation can be defined as the active involvement in a life situation (World Health Organization, 2007). It is particularly important to highlight the difference between the terms participation, involvement and engagement, as most times they are used interchangeably (Imms et al., 2016), despite the fact that the terms do not have the same meaning. Moreover, emotional engagement includes the child's

emotions in the school setting, such as happiness, sadness, anxiety or boredom towards the teacher and their peers. Last but not least, cognitive engagement refers to the child's investment in learning, self-regulation and to the usage of strategies which lead the child to cognitive ideas and skills (Fredricks et al., 2004). The three types of engagement can be measured by observations, questionnaires or by different scales. However, there is no agreement on the best method or scale by which engagement can be measured, as in some studies one engagement-scale is used for measuring all the three types, whereas in some others different scales are used for each type of engagement (Fredricks et al., 2004).

Furthermore, engagement has been linked to the child's academic achievement (Ridley, McWilliam, Oates, 2000) and may protect from school drop-out (McFerran et al., 2017). Additionally, according to many studies a child's engagement levels depend on the environmental aspects around the child (Raspa, McWilliam & Ridley, 2001). These environmental factors refer either to the social environment around the child, such as the family, the school, the peers or the neighbourhood, or the physical environment (Garbarino & Ganzel, 2000). The factors that have been found to influence students' engagement are the child's interaction with the teacher and the peers, the classroom structure and the characteristics of the tasks that need to be completed by the child (Williford, Maier, Downer, Pianta, Howes, 2013).

2.3 Interventions

There are several factors in the environment around the child that affect its development and everyday functioning in different ways. These factors affect the children in different ways and can have developmental or educational impacts on them, causing disabilities (Wolery, 2000). After identifying the causes and impacts on functioning, the appropriate treatment is necessary to improve the child's development and everyday functioning (Wolery, 2000). For that reason, effective interventions need to be planned.

An intervention can be defined as an intentional attempt of changing an existing situation for the child, considering the child itself as well as the environmental factors around the child (Trivette, Dunst & Deal, 1997). Since children with ADHD have different symptoms and difficulties and are not included in one category, different intervention strategies should be designed and implemented for each child to take account

of individual characteristics and impacts (Bölte et al., 2014). The most common treatments for children with ADHD are either psychotropic medications or behavioural interventions. Psychotropic medication can reduce the core symptoms of ADHD, and more particularly, have been shown to improve the ability of children to handle tasks and demands (Loe & Feldman, 2007). Additionally, the modification of the children's behaviour can be succeeded through several intervention strategies, such as behavioural classroom interventions, behavioural parent training interventions, encouragement and positive reinforcement of the child, with main purpose to reduce the symptoms of ADHD and to improve their participation in activities and their academic achievement (Loe & Feldman, 2007).

Despite the effectiveness of the psychopharmacological treatments, the behavioural modification approaches are mostly used in the school environment (Hart et al., 2017). The target of the intervention strategies implemented at school should also be the improvement of the academic performance and the social functioning (McConaught et al., 2011). It is particularly important that all children whether they are in need of special support or not, receive support at school. However, the support children get at school depends on the educational system each culture has, including different laws and regulations, as well as on the difficulties or problems a child faces. A child with ADHD thus would not get additional support at school within all cultures, since the problem is identified in different ways. For that reason, a universal tiered intervention system has been designed, so that all children get the support they need, while the intensity of the intervention increases depending on the need of each child individually (DuPaul & Kern, 2011).

To start with, the Universal Interventions (Tier 1) are preventive and instructive in nature and are implemented for all students in the class, to offer positive behavioural support and define the consequences for inappropriate behavior (Hart et al., 2017). Furthermore, Targeted Interventions (Tier 2) are implemented for students who are at risk for behavioral or academic difficulties and who have not responded to universal interventions (DuPaul & Kern, 2011). The targeted intervention should start by identifying the problem behaviour and further on, after the implementation of the intervention, the child's response to it should be assessed and modified if needed, before moving to the next tier of interventions (Hart et al, 2017). Targeted interventions include

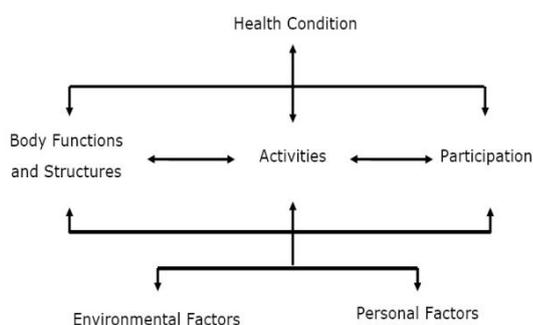
several strategies, such as the change in seating, visual schedules, instructions and guidance prior to independent work, teaching rules, reinforcement, rewards and the Daily Report Card (DRC), with proactive, educative or functional outcomes (Hart et al, 2017). Last but not least, when a child does not respond to targeted interventions and shows intensive behaviour problems, Intensive Interventions (Tier 3) follow (Hart et al, 2017). Intensive interventions usually have a longer duration and are more individualized, addressing more profound behavioural or academic problems (DuPaul & Kern, 2011). A particularly effective example of such an intervention strategy is the Individualized Education Plan (IEP) which is designed for each child specifically and is mostly used in the school settings (Hart et al, 2017).

In conclusion, it should be highlighted that the effects of an intervention in one setting does not automatically have the same results in other settings. As a result, before designing and implementing an intervention the setting should be considered (DuPaul & Kern, 2011). Children spend the majority of their weekdays at the school environment with the people who work there, where opportunities for behavioural interventions by school staff may be given. Of interest in this study therefore is the need to identify effective interventions that have been implemented within the school setting by school staff. In this study, interventions refer to different intervention programmes which are implemented through several intervention strategies.

2.4 Concept of Functioning and Disability

The International Classification of Functioning, Disability and Health, Child and Youth version (ICF-CY) was published by the World Health Organization (WHO) in

Figure 1 *ICF-CY (WHO, 2007 p. 17)*



2007 with a main purpose to be used as a common language for clinicians, educators, family members, researchers and policy-makers for describing children's everyday functioning in everyday life (WHO, 2007). The ICF-CY consists of different components and is organized in two main parts; the first part includes the Body Structures and Functions, the Participation and the Activities, while the second part includes the Environmental and the Personal factors that influence a

child's development and everyday functioning (Granlund, 2013). The term everyday functioning describes all the natural procedures included in everyday life, such as eating, drinking or playing (Adolfsson, 2013). The ICF-CY explains disability as a result of the interaction between a health condition with personal and environmental factors influencing the levels of activities and participation (De Schipper et al, 2015) (See Figure 1).

Focusing on the components of the ICF-CY, the Body Structures and Functions refer to the *'the physiological functions of body systems'* (p. 45) and to the *'anatomical parts of the body'* (p.107) respectively (WHO, 2007). In addition, the term participation is defined as *'involvement in a life situation'*, while the activities refer to the *'execution of a task or action by an individual'* (WHO, 2007 p.128). Lastly, the Environmental and the Personal factors refer to the environment around an individual and the interactions that take place in it. The environment around a child can be both the physical environment and the social environment, such as the family, the neighbourhood and the school (Garbarino & Ganzel, 2000).

The ICF-CY can provide a holistic view of the child, by exploring the interactions between the different components and the factors that are included in the environment around the child and their impact on the child's development and everyday functioning. In that way, the difficulties and the problems the child confronts can be identified to enable effective interventions impacting on daily activities to be implemented (Björck-Åkesson & Granlund, 2005).

Moreover, the ICF-CY can be used to explain the conditions such as Attention Deficit/Hyperactivity Disorder (ADHD) and impacts on activities and participation. At the level of Body Functions and Structures, ADHD affects several mental functions, such as the intellectual function, the impulse control, the attention and memory, the control of emotions and psychological functions and the higher levels of cognition, including the time management, the organization, the cognitive flexibility and the problem solving (Loe & Feldman, 2007).

Moving on to the participation component, ADHD may restrict children's participation in the educational system or other activities. More specifically, due to the body functions and structures ADHD affects, it is often more difficult for children to partic-

ipate and achieve success in the educational program and as a result they often leave school (De Schipper et al, 2015). Furthermore, ADHD can limit children’s participation in activities as well due to the difficulty of completing tasks, handling their own behaviour and managing the stress levels (Loe & Feldman, 2007).

The ICF-CY includes over 1600 categories that provide a classification of an individual’s functioning, which are organized in domains (WHO, 2007). However, this can be impractical for daily clinical use (De Schipper et al., 2015), thus the development of ICF Core Sets was captured for the selection of ICF(-CY) categories that are considered to be relevant to individuals with a particular health condition (Bölte et al., 2014). The ICF Core Sets for ADHD provide an overview of the factors that influence the functioning of an individual with ADHD and needs to be assessed.

The components of the ICF-CY are denoted by a code which includes a letter and a numeric code for the component and the chapter in the classification (*b* for Body Functions, *s* for Body Structures, *d* for Activities and Participation, *e* for Environmental Factors). In Table 1 below the codes from the ICF-CY (WHO, 2007) related to the ADHD are illustrated. More specifically, the codes for the mental function restrictions within the Body Functions and Structures component of the classification are presented, as well as the activities in which the participation of children with ADHD is limited. By using the ICF-CY it may be possible to design and evaluate effective interventions that improve children’s with ADHD participation and engagement in activities, considering and enhancing the Body Functions as well (Loe & Feldman, 2007).

Table 1

ICF-CY codes related to ADHD

Body Functions and Structures	Activities	Participation
Impulse control (b1304)	Listening (d115)	Play (d880)
Attention function (b140)	Writing (d170)	Conversation (d350)
Memory function (b144)	Calculating (d172)	Interpersonal relationships (d710)
Psychomotor control (b1470)	Focusing attention (d160)	Relationships with peers (d7504)
Emotion regulation (b1521)	Solving problems (d175)	Progressing in school educational program (d8152)
Higher-level cognitive functions (b164)	Communicating (d310)	
	Speaking (d330)	
	Managing behaviour (d250)	

2.5 School Activities

The term activity refers to the “condition in which things are happening or are being done” (English Oxford Dictionary). In this study the focus is on activities implemented at school either by staff who works at school, such as the teachers or teacher assistants, or by people from the research team. By the term *school activities*, all the activities taking place at school, whether they are in-classroom or out-classroom activities, are considered.

3 Rationale

Children with ADHD face several difficulties, such as impulsivity, attention and memory deficit, problem solving deficit, behavioural and social difficulties, which have an impact on their academic achievement and engagement. Therefore, there is a need to identify the effectiveness of interventions delivered within the school environment that have an impact on the engagement of children with ADHD in school activities. The types of intervention strategies used as well as their effects need to be examined.

4 Aim and Research Questions

The purpose of this systematic review is to explore the evidence of interventions implemented at school by school staff, in order to improve the engagement of children with ADHD in all school activities.

In regard to the aim of this paper the following research questions were established:

1. What are the types of school-based interventions implemented by school staff to improve engagement of children with ADHD at school activities?
2. What are the effects of school-based interventions implemented by school staff to improve engagement of children with ADHD at school activities?

5 Method

5.1 Systematic Review

In order to explore the types and the effects of school-based interventions implemented by teachers, aiming to improve the engagement of children with ADHD in school activities, a systematic review was conducted. A systematic review differs from a literature review, as it includes specific research question(s) that aims to be answered, a detailed description of the search method as well as of the data collection and analysis procedure, the criteria used to define the inclusion and exclusion of potential pieces of work and importantly, quality assessment criteria for the selected articles included in the review (Jesson, Matheson & Lacey, 2011).

5.2 Search procedure – data collection procedure

For this systematic review a search of databases was implemented in March, 2018. The databases used for the search were ERIC, CINAHL, PsycINFO and ProQuest Central, in order to capture educational, social, behavioural and therapeutic literature. To begin with, advanced search was implemented in all three databases. The Thesaurus was used in the databases ERIC, PsycINFO and ProQuest Central, while in the database CINAHL the ‘‘CINAHL headings’’ option was used. These advanced search tools were used in combination with free search terms. All searches were limited to peer-reviewed articles published in the English language. The search terms varied in the databases, considering the suggested terms from Thesaurus in each database as well as the synonyms of the term engagement and terms associated with the participation related constructs. In the database ERIC, the search terms ‘‘*Attention Deficit Hyperactivity Disorder*’’ AND ‘‘*Intervention*’’ AND ‘‘*Learner Engagement*’’ OR (*participation OR involvement OR persistence*) were used and the search resulted in 28 articles. In addition, in the database CINAHL the search terms ‘‘*Attention Deficit Hyperactivity Disorder*’’ AND ‘‘*Early Childhood Intervention*’’ AND (*engagement OR participation OR involvement*) were used and the search resulted in 3 articles. Moreover, in the database PsycINFO the search terms (‘‘*Attention Deficit Disorder*’’ OR ‘‘*Attention Deficit Disorder with Hyperactivity*’’) AND ‘‘*School Based Intervention*’’ AND ‘‘*Student Engagement*’’ OR (*participation OR involvement OR persistence*) were used and the search resulted in 15 articles. Last but not least, in the database ProQuest Central the search terms ‘‘*Attention Deficit Disorder*’’ AND ‘‘*Intervention*’’

AND (engagement OR participation OR involvement OR persistence) were used and the search resulted in 128 articles. The terms used in the search procedure can be found shortly illustrated in the Table in Appendix A.

5.3 Inclusion and Exclusion Criteria

After the search procedure and considering the aim and the research questions of this systematic review, specific inclusion and exclusion criteria were applied for the selection of the articles included. Within the inclusion criteria, the intervention strategies implemented only by school staff in the school environment which would have as an outcome the improvement of children's engagement in school activities were selected. The target group was children attending the elementary (primary) school, aged 5 to 13 years old, whether these had a formal diagnosis for ADHD or they were at risk for this condition. The time frame from 2000 until the present time of this systematic review was chosen based on publication of intervention studies appearing in the literature using the diagnostic criteria from the DSM-IV (APA, 1994) and anticipating fewer studies using the more recent diagnostic criteria of the DSM-V (APA, 2013). The inclusion and exclusion criteria can be found in Table 2.

Additionally, all included studies needed documentation of ethical approval. Since the content of the studies refers to children, ethical considerations should be provided in the studies included in the systematic review. The current study aimed to address ethical issues of transparency, honesty and beneficence through complete reporting of procedures, documentation of results and need for study.

Table 2

Inclusion and Exclusion Criteria

	Inclusion Criteria	Exclusion Criteria
Availability	Available full text in English Available abstract in English	Only abstract available Only full text available
Publication	Peer-reviewed articles	Discussion papers, not peer-reviewed articles, literature reviews, case studies
Intervention	Focus on interventions for children with ADHD at school activities implemented by teachers School-based interventions for improving engagement in all school activities	Interventions for children with ADHD addressed to parents Interventions for improving engagement in other activities outside school
Setting	Interventions for children with ADHD in elementary (primary) school (aged 5-13 years) Children with ADHD	Interventions for children with ADHD in preschool, middle school and high school level of education Intellectual disability
Year	2000-2018	Older studies

5.4 Title and Abstract screening process

After the search procedure in the databases ERIC, CINAHL, PsycINFO and ProQuest Central, the articles found were imported in to Covidence (Mavergames, 2013). Covidence is an online tool which helps organise into steps the screening procedure of the articles in order to conclude in the final selected articles included in the systematic review. After removing the number of articles found to be duplicates, the rest articles were screened in title and abstract level, focusing on the appropriate study design, the

targeted age group of the participants, the appropriate setting of the interventions and the desired outcome.

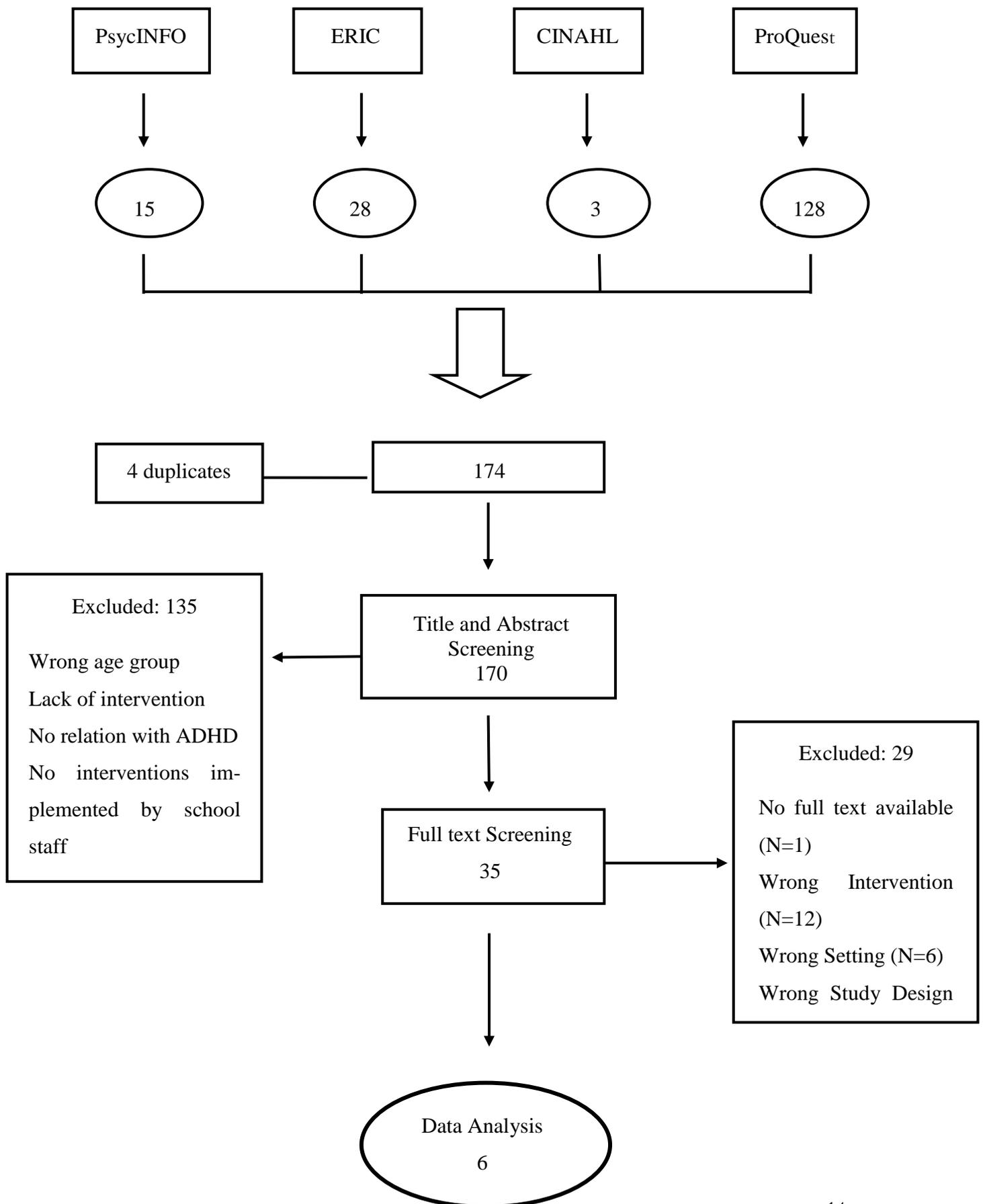
5.5 Full text screening procedure

In the full text screening level, the focus was on the method section, where the characteristics of the participants (age and further characteristics) and the details of the interventions (purpose and outcome of the intervention, the place where the intervention was implemented and from whom is applied) are described. The inclusion and exclusion criteria were applied again in order to conclude in the final articles that are included in the data extraction process for further analysis. The flowchart (see Figure 2) describing the screening process follows to give a clearer view.

5.6 Data Extraction

For the articles' extraction, a protocol including specific information was conducted and used. The extracted information included the general information of the articles – such as the author(s), the year of publication, the title of the article, the journal title and the country where the study took place-, the theoretical background used in the studies, the rationale, the aim and the research questions of the studies, as well as the information regarding the method of the studies, such as the data collection, the participants and their characteristics (diagnosis for ADHD and/or other disorders). The focus was particularly in the information regarding the interventions described in the studies. This information included the type of the intervention, the content of the intervention, the place and the time frame in which the intervention took place. Lastly, the data analysis, the results and the limitations of the studies were included in the extracted information. The protocol which was conducted for the extraction procedure of the articles can be found in Appendix B.

Figure 2 *Flow chart with the search procedure*



5.7 Quality Assessment

For the quality assessment of the selected articles the Critical Appraisal Skills Programme (CASP) checklist for quantitative Cohort studies (CASP, 2017) and the Joanna Briggs Institute Critical Appraisal checklist for Case Series studies (Moola et al., 2017) were used, depending on the study design of each article. The total rating regarding the quality of each article included in this systematic review was based on the percentage of the criteria each article fulfilled, within its study design. More specifically, three of the articles are considered to have good quality (>70% of the quality criteria fulfilled), one article are of moderate quality (>50% and <70% of the quality criteria fulfilled) and two articles are of low quality (<50% of the quality criteria fulfilled). Since the number of articles included in this systematic review was small from the beginning, no article was excluded due to low quality. In regard to the Oxford Centre for Evidence Based Medicine Levels of Evidence (OCEBM, 2009), the levels of evidence within different study designs can be ranked. Systematic Reviews and Randomized Control Trials represent the first level of evidence, Systematic Reviews of Cohort Studies the second level, while Cohort studies and Single Subject Design studies represent the third and the fourth level of evidence respectively.

In Appendix C the protocols used for the quality assessment of the included articles can be found, while in Appendix D can be found the Quality Appraisal and Levels of Evidence of the articles.

5.8 Data Analysis

After the data extraction, quality appraisal and determination of the levels of evidence, the data content analysis followed. A content analysis was used as a method to analyze and organize the results, by creating categories and including tables to support the text (Mantzoukas, 2007). First of all, the general information of the articles is presented as an overview of the studies included in the review. As both of the research questions focus on the engagement of children with ADHD, any variations in definitions of the term engagement were examined first.

In regard to the first research question, the types of school-based interventions found in the articles included in the review were extracted in categories and were further analyzed depending on their frequency in the articles.

To address the second research question, the change towards the engagement of children with ADHD before and after the implementation of the school-based interventions was measured, so that the effects of the interventions on improving the engagement can be shown. For assessing the effectiveness of the interventions the effect size was intended to be calculated. In this study the effect size was used as a quantitative measure of the difference between the engagement of children with ADHD before and after the intervention was introduced. For measuring the effect size, the following *Cohen's d* formula was calculated. *Cohen's d* is an effect size for indicating the difference between two means and it is calculated as the difference between the two means divided by the pooled standard deviation (Lakens, 2013). The bigger Cohen's *d* is, the greater the difference of the children's engagement before and after the implementation of the intervention is as well (Cohen, 1969). The following formula was used to calculate the *Cohen's d*:

$$\frac{M_1 - M_2}{S_{\text{pooled}}}$$

where M_1 is the mean of the group 1 and M_2 is the mean of the group 2, divided by the pooled standard deviation for the two groups. The pooled standard deviation (S_{pooled}) stands for the weighted average of standard deviations for two or more groups (Lakens, 2013). Having as reference Cohen (1969), an effect size of 0.2 is described as 'small', of 0.5 as 'medium' and of 0.8 and above as 'large' respectively.

6 Results

6.1 Overview of the Results

The database search resulted in 174 articles from which 4 articles were removed as duplicates and the rest 170 were screened in title and abstract level. Out of 170 articles, 135 were excluded due to the wrong age group of the participants, the wrong interventions and the wrong study design. Subsequently, 35 articles were included in the full-text screening process, out of which 12 articles described wrong types of interventions, either because they were implemented by people other than school staff or because the expected outcome was not the improvement of the engagement of children with ADHD in school activities. In addition, six articles were excluded due to the wrong setting, as the participants of the studies did not belong to the targeted age group (5-13 years old students; not pre-school, middle-school or high-school students) and the participants did not satisfy the criteria for ADHD, according to the DSM-IV (APA, 1994). Moreover, five more articles were excluded due to the wrong study design (case studies, literature reviews) while 1 article was excluded as it could not be found in full text. Finally, six articles were included in the data extraction process for further analysis.

The six articles that satisfied the inclusion criteria were included in the systematic review for further analysis within the research questions. More specifically, the selected articles included interventions implemented at school by school staff, and mostly by the teachers, having as expected outcome the improvement of the engagement of children aged 5-13 years old with ADHD. This was succeeded mostly by observing and measuring the change in the outcomes from pre- to post- intervention. The articles were published between 2010 and 2017 in journals within special education and psychology fields. An overview of the studies can be found in Table 3 below.

Out of the six studies included in the systematic literature review, five studies were implemented in the USA, while one study was set in Turkey. All the studies provide information about intervention programs and strategies implemented in elementary schools by school staff. In three studies (Study Numbers #1, #4, #5) the intervention was implemented by the classroom teachers, while in two studies (#2, #3) the intervention was implemented by both the classroom teachers and a person from the re-

search team responsible for the data collection. Additionally, in one study (#6) the intervention was implemented by both a teacher and a peer of the child who had the intervention. All intervention programs and strategies described in the studies focused on increasing the engagement of students with ADHD in school activities, whether these activities were school subjects (i.e. Math, English) (#1, #2, #3, #4, #5) or after-school homework activities (#6).

Five out of six studies (#1, #2, #3, #5, #6) were Single Subject Design studies and one (#4) was a Cohort study. The Single Subject Design studies had either two or more than two phases. More specifically, some studies had the form of A-B (#1, #2, #6), where A is the baseline phase (before the intervention was applied) and B is the phase in which the intervention is applied, while other studies had more than one baseline or intervention phases, having the form A-A-B (#3) or A-B-A-B (#5, #6). Some of the studies (#2, #4, #5) also included follow-up sessions after the implementation of the intervention.

Table 3

Overview of the studies

#*	Author(s)	(Year)	Country	Type of study	Participants (students)	Intervention	Implemented by	Activities	Outcome (effect size)	Quality Assessment
1	Cho & Blair	(2017)	USA	Single Subject Design study	1 male 1 female	Multicomponent Function Based Intervention Strategies	Teacher	English Language Arts and Maths	No data for EF calculation	70%
2	Ozdemir	(2011)	Turkey	Single Subject Design study	4 males	First Step to Success (FSS) Intervention Program	Coach of the program and teacher	All activities	No data for EF calculation	80%
3	Cirelli, Sidener, Reeve&Reeve	(2016)	USA	Single Subject Design study	2 males	Activity Schedules	Experimenter of the program and teacher	In-classroom activities	No data for EF calculation	50%
4	Fabiano et al.	(2010)	USA	Cohort	-63 children aged 6-12 years old	Daily Report Card (DRC)	Teacher	All activities	Academic Achievement: -Reading: 0,02 -Maths: 0,08 Classroom Academic Performance: -Academic Success: 0,37 -Academic Productivity: 0,55	85%
5	Vogelgesang, Bruhn, Coghill-Behrends, Kern&Troughton	(2016)	USA	Single Subject Design study	1 male 2 females	SCORE IT app.	Teacher	In-classroom activities	No data for EF calculation	60%
6	Gruvogel-Macaleese&Wallace	(2010)	USA	Single Subject Design study	1 male 2 females	Peer Mediated Intervention	Teacher and peer of the target child	Afterschool homework activities	No data for EF calculation	35%

#= Study Number

6.2 Quality Appraisal

Three studies (#1, #2, #4) were of high quality, one of moderate quality (#5) and two meeting only 50% or less of appraisal criteria (#3, #6). Thus interpretation of findings from these two studies (#3, #6) should be done with caution in view of the significant risk of bias. Study (#4) thus represents level three of evidence (Cohort studies), while the other studies (#1, #2, #5) represent level four of evidence on the OCEBM levels (OCEBM, 2009). The remaining studies (3, 6) were not ranked on the OCEBM levels due to poor quality.

6.3 Definitions for Engagement

The focus of this paper was on interventions implemented at school, aiming to improve the engagement of students with ADHD in all activities taking place at school. However, engagement as an outcome among the studies included in the systematic review was defined in different ways.

Table 4

Definitions for engagement

Definitions:	#	1	2	3	4	5	6
Following teacher's directions		X	X	X		X	
Following the sequence of class activities		X	X	X		X	
Completing given tasks		X				X	
Asking for help		X				X	
Participating in class discussions		X	X			X	
Using appropriately work materials				X		X	
Following the classroom rules						X	
Academic Achievement					X		
On-task/Off-task behaviour			X	X			X

#= Study Number

The concepts that were mostly used to define engagement were ‘‘academic engagement’’ (#1, #4, #5) and ‘‘on-task/off-task behaviour’’ (#2,#3,#6), including further definitions and descriptions within each concept. The definitions that were mostly used in the studies were ‘‘following the teacher’s directions’’ and ‘‘following the sequence of class activities’’ (#1, #2, #3, #5). In addition, engagement was defined as the participation in classroom activities in three studies (#1, #3, #5). This definition included two dimensions; the child talking about the tasks

of the class, but also listening to the others' talking. Moreover, the definitions as 'completing the given tasks' and 'asking for help' were included in two studies (#1, #5), focusing on concentrating on the academic content and on the help the child should ask from the teacher whenever had a difficulty. Similarly, engagement was defined as 'using appropriately work materials' in two studies (#3, #5), as materials should be used as they were designed to be used. The definition which focused on 'following the classroom rules' was included only in one study (#5), not independently but in combination with further definitions. In another study engagement was related to the academic engagement of the students and was linked to the increase of their academic achievement (#4). Lastly, in one study (#6) no definition for engagement that corresponded to the other studies in this review was included. However, the definition of off-task behaviour was used in order to describe the opposite of the expected behavioural outcome. For that reason, it can be assumed that engagement in this study could be defined as on-task behaviour.

6.4 Types of the intervention strategies

In regard to the first research question, the intervention strategies, through which the intervention programmes described in the included studies were implemented, were extracted in categories and further analyzed, depending on the frequency of their reference in the studies.

All the studies included behavioural intervention programmes focusing on functioning outcomes, such as the academic and social functioning. Each of the six studies (#1, #2, #3, #4, #5, #6) described a different behavioural intervention programme, which was implemented through several intervention strategies (See Table 6).

Table 6

Intervention Strategies of the six articles

Intervention Strategies:	#:	1	2	3	4	5	6
Self Monitoring		X				X	
Reinforcement		X	X		X	X	X
Extinction		X					X
Modification of schedule		X		X			X
Modification of activities		X					
Seating arrangement		X					
Verbal prompts		X		X			
Activity schedules		X		X			
Rewards			X	X	X		
Peer support			X				X
Self-recording/rating sheet		X				X	
Attention provided to the target child		X					X

#= Study Number

The intervention strategy that was mostly used in the articles was that of positive reinforcement (#1, #2, #4, #5, #6). The teacher and the people who implemented the intervention enhanced the desired behaviour of the child by providing positive feedback. Furthermore, the next intervention strategies that were mostly common between the studies were the modification of the schedule (#1, #3, #6), the provision of rewards (#2, #3, #4) and the verbal prompts (#1, #3, #6). The modification of the schedules refers to the frequent breaks during the activities the target children need in order to walk around and stretch a bit. In addition, rewards

were used in order to increase the appropriate behavior either as a main intervention strategy in one study (#2) or after the implementation of another intervention strategy (#3, #4). Lastly, verbal prompts were used from the persons who implemented the interventions in order to help the targeted children achieve the expected outcome.

Self-monitoring, behavioral intervention with extinction principles, activity schedules, peer support, self-recording/rating sheets and attention provided to the child were intervention strategies that were used in fewer studies. More specifically, self-monitoring (#1, #5) was used as an intervention for teaching children with ADHD to complete tasks and monitor their behavior independently, without prompts. This was done either as a verbal procedure (#1) or by using the iPad application *SCORE IT* (#5). Regarding the extinction, which focuses on ignoring the inappropriate behavior of the children by enhancing only the desired behavior, was used only in two studies (#1, #6), either as an independent strategy (#1) or in combination with prompts (#6). As a result, the attention to the appropriate behavior of the targeted child was combined with the extinction strategy in the same two studies (#1, #6). Similarly, activity schedules were used as visual cues in order to help the children organize and implement the target activities (#1, #3). A sheet was used in two studies (#1, #5) either as a self-recording sheet, so that children can record and assess their performance in activities independently or in combination with prompts from the teacher (#1), or as a rating sheet in which the children rated their performance with a score (#5). Subsequently, the peer support (#2, #6) was used as an independent intervention strategy (#6) or in combination with other strategies (#2) for enhancing the desired behavior through the support of a peer.

Lastly, modification of the activities and the seating arrangement intervention strategies were included only in one study (#1); activities were modified so that they fitted the abilities and preferences of the children and their seats in the classroom were arranged in order to have a better vision of the board and not to get distracted.

6.5 Effects of the interventions on students' engagement

For assessing how effective the interventions implemented at schools, the effect size is calculated by measuring the Cohen's *d*. However, the calculation of the Cohen's *d* could not be succeeded in five out of the six studies included in the systematic review (#1, #2, #3, #5, #6) due to lack of the appropriate statistical data.

Therefore, the Cohen's *d* was calculated only in one study (#4), in order to find the change on the engagement of children with ADHD before and after the intervention was implemented. Within the study (#4) included in the systematic review, the effect size regarding the Academic Achievement of the participants for two courses was small ($d= 0.02$ and $d=0.08$), while regarding the Academic Success and the Academic Productivity of the participants small to medium effect sizes were achieved ($d= 0.37$ and $d= 0.55$ respectively).

In regard to the single subject design studies, descriptive information in each article was considered in order to conclude on how effective on improving the children's engagement the interventions were. The focus was on the change between the children's engagement from the phase when the intervention had not yet started (baseline) to the phase after the intervention was completed. Each article had a different setting for the interventions, including different phases. Two articles (#1, #2) had one baseline phase and one intervention phase, while three articles (#3, #5, #6) had two baseline and two intervention phases, in which children received the intervention. Moreover, four articles (#2, #3, #5, #6) also included follow up sessions, where data was collected regarding the students' engagement.

In all five articles (#1, #2, #3, #5, #6) two phases were taken into consideration for analyzing the effects of the interventions on the students' engagement. As the first phase, in which the intervention had not yet been applied, the baseline was considered. Since all the articles should be compared on similar dimensions, the baseline phase right before the intervention was applied was considered as the first phase, while the phase right after the implementation of the intervention was considered as the second phase. In all articles the mean of the students' engagement increased between the baseline phase and the phase after the intervention was implemented. The average on the means of students' engagement between the baseline phase and the phase after the intervention was completed can be found below (see Table 5).

Table 5

Percentage of the Means of the students' engagement during Baseline phase and intervention phase for Single Subject Design Studies

#	Baseline Phase	Phase after the implementation of the intervention
1	Male: 75% for writing 73% for maths 78% for reading Female: 76% for writing 78% for reading	Male: 97% for writing 95% for maths 96% for reading Female: 93% for writing 95% for reading
2	Male 1: 18% Male 2: 20% Male 3: 37% Male 4: 44%	Male 1: 78% Male 2: 70% Male 3: 83% Male 4: 77%
3	Male 1: 58% Male 2: 52%	Male 1: 100% Male 2: 100%
5	Male: 21.33 % for baseline ₁ 54.5% for baseline ₂ Female 1: 43% for baseline ₁ 41.33 % for baseline ₂ Female 2: 46.35% for baseline ₁ 48.67% for baseline ₂	Male: 86.67% for Intervention ₁ 86.33% for Intervention ₂ Female 1: 86% for Intervention ₁ 88.67% for Intervention ₂ Female 2: 86% for Intervention ₁ 84% for Intervention ₂
6	Male: 89% off-task behavior Female 1: 76% off-task behavior Female 2: 63% off-task behavior	Male: 12% off-task behavior Female 1: 13% off-task behavior Female 2: 9% off-task behavior

#= Study Number

Furthermore, it should be noted that in one study (#5) there were two baseline phases between which the intervention was applied to the students. For that reason, the average on the mean of students' engagement between the Baseline₁ phase and the Intervention₁ phase, and the Baseline₂ and the Intervention₂ phase should be considered respectively. Additionally, in the last study (#6) the means illustrated in Table 5 represent the off-task behavior of the students.

7 Discussion

The aim and the research questions of this systematic review focused on the types of the intervention strategies implemented at school and their effects to improve the engagement of children with ADHD in school activities.

In summary, the database search procedure resulted in 170 articles of which 35 articles were screened in full-text finding six to meet criteria to be included in the systematic review. After the quality assessment of the articles, three articles were considered of good quality, two articles of moderate quality and one article of low quality. According to the OCEBM (2009), the studies included in the systematic review are on the third (one Cohort study #4) and the fourth (Single Subject Design studies, #1, #2, #3, #5, #6) levels of evidence. No article was excluded from the content analysis due to low quality, since the initial number of articles was small.

Regarding the quality of Single Subject Design studies, these can be a great source of evidence for Evidence Based Practice (EBP), since different interventions and their effects can be evaluated. Additionally, Single Subject Design studies are mostly used in intervention studies, due to their ability to deal with heterogeneous populations. However, the quality of these methodology studies is under discussion in literature, since it was only recently that quality indicators for appraising publications have been published (Wendt & Miller, 2012).

7.1 Reflections on the findings and Practical Implications

7.1.1 Definitions for Engagement

This paper focused on intervention strategies implemented within the school environment with desired outcome the improvement of the engagement of children with ADHD in school activities. The concept of engagement though was perceived in different ways among the studies included in the systematic review, confirming the fact that the definitions for the term vary (Imms et al., 2016). All the definitions used for the term engagement are related to the improvement of the academic achievement of the students and refer to the behavioural engagement, as they focus on the adherence to the classroom rules (“following the teacher’s directions”, “following the sequence of class activities”, “using appropriately work materials”, “following the classroom rules”), the involvement and participation in academic activities (“completing given tasks”, “asking for help”, “participating in class discussions”) and on behaviours related to concentration and attention (“on-task/off-task”) (Fredricks et al, 2004).

In one study (#4) the term ‘academic achievement’ was used to define engagement without including other concepts. However, it can be argued that the academic achievement of the students with ADHD could be enhanced from other environmental factors, such as extra support at home for the homework, or as a natural progress as well and not only because their engagement is improved (Raspa, McWilliam & Ridley, 2001). Therefore, it can be assumed that ‘academic achievement’ may not represent a complete definition of the term engagement.

Lastly, one aspect for discussion could be the use of the term ‘participation’ for describing the term ‘engagement’. In some of the studies engagement was defined as the ‘participation in classroom activities’. As already mentioned, the terms ‘engagement’ and ‘participation’ usually are being used interchangeably, yet they are defined differently (Imms et al, 2016). Participation is defined considering the two dimensions of the attendance and the active involvement and engagement of an individual in a life situation (Granlund, 2013), while engagement includes the meaning of the participation and involvement in academic activities, within the use of the term in this study (Fredricks et al., 2004). Consequently, the terms may be defined in different ways but each term can be used to define the other.

7.1.2 Types and Effects of the Interventions

Within the first research question, the types of the intervention strategies, through which the intervention programmes described in the studies included in this paper were implemented, need to be addressed. To be more specific, all the intervention strategies described and used in the studies were designed to handle and reduce the symptoms of ADHD that children have in order to improve their engagement in school activities. Furthermore, most of the intervention strategies described in the articles may be considered within the classification ‘Targeted behavioural interventions’ (Tier 2), targeting students who are at risk or face behavioural and academic difficulties (DuPaul & Kern, 2011). More particularly, the rewards, the reinforcement, the verbal prompts, the seating arrangement and the activity schedules were found to be more commonly used intervention strategies among the studies aimed to modify the behaviour of the students and help them handle the symptoms of ADHD so that their engagement in school activities is enhanced.

The articles identified for inclusion in this review can be linked to the Participation and Activities components of the ICF-CY (WHO, 2007), since engagement is related to the participation constructs in activities at school, such as writing (d170), listening (d115), playing (d880),

interacting with the peers (d7504) or communicating (d310) (WHO, 2007). However, the improvement of the engagement of children with ADHD is also related to the Body Functions and Structures components of the classification, since the symptoms of ADHD, such as the impulsivity (b1304), the attention (b140) and memory (b144) deficit, the organization (b164) and the problem solving (d175) function (WHO, 2007), need to be reduced to enhance the participation and to improve the engagement in activities (Loe & Feldman, 2007). Therefore the interaction and connection between the different components of the ICF-CY highlight the need to view the child holistically in order to achieve the purpose. In other words, in order to improve the engagement of children with ADHD it is not enough to focus only on the Participation and Activities components, but also on the interaction of these components with the Body Functions and Structures components.

Another issue for discussion is the effects of the interventions to improve the engagement of children with ADHD. Despite the fact that data were missing for calculating the effect size, which provided stronger evidence, in most studies, the studies identified showed support for behavioural interventions to promote engagement of children with ADHD. Engagement of children with ADHD in school activities was improved in all studies, whether this was shown by the increase of the mean of engagement between the baseline and the intervention phase or by the effect size.

Within the studies in which data for calculating the effect size were missing (#1, #2, #3, #5, #6) the means of the engagement of students before the intervention was applied and after the intervention was implemented were compared indicating an increase between the variables. By the increase of the children's engagement before and after the intervention was implemented it can be assumed that the engagement in school activities was improved. However, this change in the engagement of students could also be interpreted as a natural procedure which was affected by other factors. Consequently, there cannot be stated as a conclusion that regarding these studies the interventions had an effect on children's engagement.

Furthermore, in study #4 the effect size regarding the Academic Achievement of the students in the Reading and Math courses and the Classroom Academic Performance, including the dimensions of Academic Success and Academic Productivity, was calculated, indicating a small and a medium effect of the intervention on children's engagement respectively, according to Cohen's classification (Cohen, 1969). According to Coe (2002), educational interven-

tions have shown small effects, especially on students' academic achievement according to Cohen's classification. This could be explained by the fact that the effect size is calculated within a sample of the population as a whole, which has a wide variation of characteristics. Moreover, students' achievement is harder to be influenced in some cases, due to additional factors, such as the variety of strategies that many schools are already using (Coe, 2002). As a result, it seems that the small effect of the interventions illustrated is more difficult to interpret without placing these in the context of individual children. However, in the field of education and in view of the multiple impacts on child development, even a small change on the academic achievement of students, shown by an effect size as small as 0.1, could still be a significant improvement (Coe, 2002).

7.2 Methodological Challenges and Limitations

In this study six articles satisfied the inclusion criteria and were further analyzed. During the search and the screening process of the articles, it was particularly difficult to find studies referring to interventions for children with ADHD implemented at the school environment, as most of the intervention programmes and strategies found in most articles referred to interventions implemented by parents or within the home environment in general. Another difficulty was to find intervention strategies implemented at school for children aged 5-13 years old, as most articles focused on high school (secondary school) children (aged 14-18 years old). Last but not least, the main subject of this paper was the improvement of the engagement of children with ADHD. However, many papers found during the search procedure did not focus directly on the improvement of the engagement of children with ADHD but on the improvement of the social and behavioural skills of children with ADHD, which could also have as an outcome the improvement of the engagement.

Additionally, almost all included in the study articles were conducted in the USA, whereas only one article was conducted in Turkey. As a result, the intervention strategies described in the studies and their effects on children with ADHD refer to the context of one country. Therefore, the results cannot be generalized within all contexts, as specific factors may affect them.

Subsequently, in the selected articles the intervention programmes were described either in the background or in the method section, including only the main information about the intervention. Information about the participants' selection in some articles was missing (#1, #5,

#6) as well as information about the different steps for the implementation of the interventions.

Another methodological problem was that there was no agreed definition for the term ‘‘engagement’’, as different terms were used among the studies. As a result, the articles included in this study synthesized similar concepts regarding the term ‘‘engagement’’ depending on the outcomes of the term used each time. However, this procedure may not be valid, as this was based on the judgment of one reviewer.

Furthermore, after deciding on the search terms for the database search performance, specific inclusion and exclusion criteria were established. The inclusion and exclusion criteria were used during the screening process of articles for selecting the ones that would be included in the systematic literature review. The decision within some criteria, such as the language of the article, the setting of the intervention or the year of the publication, was straightforward. However, the decision upon other criteria, such as the design and the method of the article was more complex as these topics were not always clear in the articles. Also, the quality assessment process was performed using two already existing quality assessment tools, depending on the study design of each article. This procedure though was performed by one reviewer and for that reason there is a risk that determinations for inclusion and quality ratings may be biased.

Finally, regarding the second research question the effect size needed to be calculated to find the effect of the intervention after its implementation. However, in most studies apart from one (#4), the effect size, which indicates stronger evidence, could not be calculated as the data needed for calculating the Cohen’s d were missing. As a result, descriptive information was included for answering the first research question. Lastly, since most studies (#1, #2, #3, #5, #6) have a Single Subject Design, it is hard to make generalizations from the results. Therefore the validity of the results can be questionable.

7.3 Future Research Implications

Studies have demonstrated the need of interventions implemented at school for children with ADHD, in order to improve their academic engagement as well as their social and behavioural functions. However, few studies were identified that were implemented at the school environment rather than interventions implemented at home. Considering that children spend about half of their day at school, for over half of the number of days per year, intervention opportunities to improve school outcomes appear to be missing, at least within the literature.

The current paper demonstrates the need of effective interventions implemented at school for children with ADHD, in order to improve their engagement in school activities. The interventions need to be evaluated and their effects measured for assessing their effectiveness.

Further research focusing on more intervention programmes and strategies implemented at school and assessing their effects on the engagement of students with ADHD is required, considering especially the different characteristics among different cultures, without focusing in one only culture.

8 Conclusion

Attention Deficit/Hyperactivity Disorder (ADHD) is a developmental disorder that can be diagnosed from an early age by the symptoms of inattention, hyperactivity and impulsivity, according to the Diagnostic and Statistical Manual of Mental Disorders (DSM)- 4th (APA, 1994), or the more recent, 5th edition (APA, 2013). Children with ADHD have difficulties in focusing on a task, controlling their movements and their behaviour due to the symptoms, thus they usually have low academic performance and difficulties in participation and engagement in activities with their peers.

Engagement is a multidimensional construct and there is no agreed definition for the term among the literature (Imms et al., 2016), thus the need for a comprehensive definition. Children's engagement refers to the adherence to the classroom rules, involvement and participation in academic activities, concentration, persistence and attention (Fredricks et al., 2004). For that reason, the need to identify effective interventions implemented within the school environment for improving the engagement of children with ADHD should be highlighted.

In conclusion, children with ADHD face several difficulties in their academic performance and social skills due to the symptoms of inattention, impulsivity and hyperactivity, having impacts on their psychosocial development. It is particularly important that effective interventions are designed for these children in order to improve their everyday functioning. Research has focused on interventions implemented mostly at home or in other settings by parents. However, children spend most of their time during week days at school with people who work there, such is the teacher. Therefore, it is particularly important that more research is done regarding intervention strategies within the school environment to improve the engagement of children with ADHD in school activities.

9 Reference List

Adolfsson, M. (2013). Applying the ICF-CY to identify children's everyday life situations: A step towards participation-focused code sets. *International Journal of Social Welfare*, 22(2), 195-206

American Psychiatric Association [APA] (1994). *Diagnostic and Statistical Manual of Mental Disorders (4th edition)*. Washington, DC.

American Psychiatric Association [APA] (2013). *Diagnostic and Statistical Manual of Mental Disorders (5th edition)*. Washington, DC.

Björck-Åkesson, E., & Granlund, M. (2005). Early Intervention in Sweden – A Developmental Systems Perspective. In *The Developmental Systems Approach to Early Intervention*, edited by M.Guralnick, 571–591. Baltimore, MD: Paul H. Brookes.

Bölte, S., de Schipper, E., Holtmann, M., Karande, S., de Vries, P., Selb, M., Tannock, R. (2014). Development of ICF Core Sets to standardize assessment of functioning and impairment in ADHD: the path ahead. *European Child and Adolescent Psychiatry*, 23(12), 1139-1148. DOI: 10.1007/s00787-013-0496-5

Cho, S. & Blair, K. (2017). Using a Multicomponent Function-Based Intervention to Support Students with Attention Deficit Hyperactivity Disorder. *The Journal of Special Education*, 50(4), 227-238. DOI: 10.1177/0022466916655186

Cirelli, C., Sidener, T., Reeve, K., Reeve, S. (2016). Using Activity Schedules to Increase On-Task Behavior in Children at Risk for Attention-Deficit/Hyperactivity Disorder. *Education and Treatment of Children*, 39(3), 283-300.

Coe, R. (2002). *It's the effect size, stupid: what effect size is and why it is important*. Paper presented at the Annual Conference of the British Educational Research Association, University of Exeter, Exeter, Devon, England

Cohen, J. (1969). *Statistical Power Analysis for the Behavioral Sciences*. NY: Academic Press

Critical Appraisal Skills Programme. (2017). *CASP Checklists*. Retrieved from: <https://casp-uk.net/casp-tools-checklists/>

De Schipper, E., Mahdi, S., Coghill, D., De Vries, P., Shur-Fen Gau, S., Granlund, M., Holrmann, M., Karande, S., Levy, F., Almodayfer, O., Rohde, L., Tannock, R., Bölte, S. (2015). Towards an ICF core set for ADHD: a worldwide expert survey on ability and disability. *European Child & Adolescent Psychiatry*, 24(12), 1509-1521.
Doi: [10.1007/s00787-015-0778-1](https://doi.org/10.1007/s00787-015-0778-1)

DuPaul, G.J. & Kern, L. (2011). *Young children with ADHD: Early Identification and Intervention*. Washington, DC, US: American Psychological Association.

Epstein, J. & Loren, R. (2013). Changes in the Definition of ADHD in DSM-5: Subtle but Important. *Neuropsychiatry (London)*, 3(5), 455-458. DOI: 10.2217/npv.13.59

Fabiano, G., Vujnovic, R., Pelham, W., Waschbusch, D., Massetti, G., Pariseau, M., Naylor, J., Yu, J., Robins, M., Carnefix, T., Greiner, A., Volker, M. (2010). Enhancing the Effectiveness of Special Education Programming for Children With Attention Deficit Hyperactivity Disorder Using a Daily Report Card. *School Psychology Review*, 39(2), 219-239.

Fredricks, J. A., Blumenfeld, P.C. & Paris, A. H. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research*, 74(1), 59-109.

Garbarino, J. & Ganzel, B. (2000). The human ecology of early risk. In J.P. Shonkoff & S.J. Meisels (Eds.), *Handbook of early childhood intervention* (2nd ed., pp. 76-93). New York: Cambridge University Press.

Granlund, M. (2013). Participation – challenges in conceptualization, measurement and intervention. *Child: care, health and development* 39(4), 470-473

Grauvogel-MacAleese, A. & Wallace, M. (2010). Use of Peer-Mediated Intervention in Children with Attention Deficit Hyperactivity Disorder. *Journal of Applied Behavior Analysis*, 43(3), 547-551

Hart, K. C., Fabiano, G. A., Evans, S. W., Manos, M. J., Hannah, J. N., Vujnovic, R. K. (2017). Elementary and Middle School Teachers Self-Reported Use of Positive Behavioral Supports for Children with ADHD: A National Survey. *Journal of Emotional and Behavioral Disorders*, 25(4), 246-256.

Heward, W. (2009). *Exceptional Children: An Introduction to Special Education*, 9th Edition. The Ohio State University: Pearson.

Imms, C., Granlund, M., Wilson, P. H., Steenbergen, B., Rosenbaum, P. L., Gordon, A. M. (2016). Participation, both a means and an end: a conceptual analysis of processes and outcomes in childhood disability. *Developmental Medicine & Child Neurology*. DOI: 10.1111/dmcn.13237

Jesson, J., Matheson, L. & Lacey, F. M. (2011). *Doing your literature review. Traditional and Systematic Techniques*. London: SAGE

Lakens, D. (2013). *Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAS*. Retrieved from: <https://doi.org/10.3389/fpsyg.2013.00863>

Loe, I. & Feldman, H. (2007). Academic and Educational Outcomes of Children with ADHD. *Journal of Pediatric Psychology*, 32(6), 643-654. DOI: 10.1093/jpepsy/jslo54

Mantzoukas, S. (2007). *Qualitative research in six easy steps. The epistemology, the methods and the presentation*. Thames Valley University, London, UK

Mavergames, C. (2013). *Covidence* (Systematic Review Software).

McConaught, S. H., Volpe, R., Antshel, K. M., Gordon, M., Eiraldi, R.B. (2011). Academic and Social Impairments of Elementary School Children with Attention Deficit Hyperactivity Disorder. *School Psychology Review*, 40(2), 200-225.

McFerran, K. S., Crooke, A. D. & Bolger, L. (2017). Promoting engagement in school through tailored music programs. *International Journal of Education and Arts*, 18(3). Retrieved from: <http://www.ijea.org/v18n3/>.

Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Qureshi, R., Mattis, P., Lisy, K., Mu, P-F. (2017). Systematic reviews of etiology and risk. Chapter 7. In: Aromataris E, Munn Z (Editors). *Joanna Briggs Institute Reviewer's Manual*. The Joanna Briggs Institute, 2017. Available from <https://reviewersmanual.joannabriggs.org/>

Oxford Centre for Evidence-Based Medicine. (2009). Oxford Centre for Evidence Based Medicine-Levels of Evidence. Retrieved from: <https://www.cebm.net/2009/06/oxford-centre-evidence-based-medicine-levels-evidence-march-2009/>

Ozdemir, S. (2011). The Effects of the First Step to Success Program on Academic Engagement Behaviors of Turkish Students with Attention-Deficit/Hyperactivity Disorder. *Journal of Positive Behavior Interventions*, 13(3), 168-177. DOI: 10.1177/1098300710373503

Raspa, M. J., McWilliam, R. A., Ridley, S. M. (2001). Child Care Quality and Children's Engagement. *Early Education and Development*, 12(2), 209-224. DOI: 10.1207/s15566935eed1201_3

Ridley, S. M., McWilliam, R. A. & Oates, C. S. (2000). Observed Engagement as an Indicator of Child Care Program Quality. *Early Education and Development*, 11(2), 133-146. DOI: 10.1207/s15566935eed1102_1

Trivette, C. M., Dunst, C. J., & Deal, A. G. (1997). Resource-based approach to early intervention. In S. K. Thurman, J. R. Cornwell & S. R. Gottwald (Eds.), *Contexts of early intervention: Systems and settings* (pp. 73-92). Baltimore: Brookes

United Nations General Assembly (1989). Convention on the Rights of the Child. Retrieved from: <http://www.ohchr.org/Documents/ProfessionalInterest/crc.pdf>

United Nations General Assembly (2006). Convention on the Rights of Persons with Disability. Retrieved from: <http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf>

Vogelgesang, K., Bruhn, A., Coghill-Behrends, W., Kern, A., Troughton, L. (2016). A Single-Subject Study of a Technology-Based Self-Monitoring Intervention. *J Behav Educ*, 25, 478-497. DOI: 10.1007/s10864-016-9253-4

Wendt, O. & Miller, B. (2012). Quality Appraisal of Single-Subject Experimental Designs: An Overview and Comparison of Different Appraisal Tools. *Education and Treatment of Children*, 35(2), 235-268.

Williford, A. P., Maier, M. F., Downer, J. T., Pianta, R. C., Howes, C. (2013). Understanding how children's engagement and teacher's interaction combine to predict school readiness. *Journal of Applied Developmental Psychology*, 34, 299-309

Wolery, M. (2000). Behavioral and educational approaches to early intervention. In J.P. Shonkoff & S.J. Meisels (Eds.), *Handbook of early childhood intervention* (2nd ed., pp. 179-203). New York: Cambridge University Press. [e-book]

World Health Organisation [WHO]. (2007). *International Classification of Functioning, Disability and Health: Children & Youth Version: ICF-CY*. Retrieved from http://apps.who.int/iris/bitstream/10665/43737/1/9789241547321_eng.pdf

I0 Appendix

A. Search Terms

ERIC	CINAHL	PsycINFO	ProQuest Central
"Attention Deficit Hyperactivity Dis- order" AND "Intervention" AND "Learner engage- ment" OR (participation OR involvement OR persistence)	"Attention Deficit Hyperactivity Disor- der" AND "Early Childhood Intervention" AND (engagement OR participation OR in- volvement OR per- sistence)	("Attention Defi- cit Disorder" OR "Attention Deficit Disorder with Hy- peractivity") AND "School Based In- tervention" AND "Student En- gagement" OR (participation OR involvement OR persistence)	"Attention Deficit Disorder" AND "Intervention" AND (engagement OR participation OR involvement OR persistence)

B. Extraction Protocol

General Information	Author(s) Year Title Journal Country
Background Information, purpose and research question(s)	Theoretical Background Rationale Purpose of the study Research Question(s)
Method	Type of the study (qualitative/quantitative/mixed methods) Data collection Participants Characteristics of the participants (ADHD/ADD) School (Yes/No)
Description of the Intervention	Type of the Intervention programme Content of the intervention Place of the intervention Time frame of the intervention
Results	Results of the intervention Outcome engagement (Yes/No)
Discussion	Limitations of the study Practical Implications
Quality Assessment	High/Medium/Low Quality of the study according to the protocol

C. Quality Assessment Tools

Joanna Briggs Institute Critical Appraisal Checklist for Case Series

	Yes	No	Unclear	Not applicable
1. Were there clear criteria for inclusion in the case series?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Was the condition measured in a standard, reliable way for all participants included in the case series?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Were valid methods used for identification of the condition for all participants included in the case series?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Did the case series have consecutive inclusion of participants?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Did the case series have complete inclusion of participants?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Was there clear reporting of the demographics of the participants in the study?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Was there clear reporting of clinical information of the participants?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Were the outcomes or follow up results of cases clearly reported?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Was statistical analysis appropriate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Critical Appraisal Skills Programme Checklist for Cohort Studies

<p>1. Did the study address a clearly focused issue?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>2. Was the cohort recruited in an acceptable way?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>3. Was the exposure accurately measured to minimise bias?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>4. Was the outcome accurately measured to minimise bias?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>5. a) have the authors identified all important confounding factors?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>b) Have they taken account of the confounding factors in the design and/or analysis?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>6. a) was the follow up of subjects complete enough?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>b) was the follow up of subjects long enough?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>7. What are the results of this study?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>8. How precise are the results?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No</p>
<p>9. Do you believe the results?</p>	<p><input type="radio"/> Yes <input type="radio"/> Can't tell</p>

	<input type="radio"/> No
10. Can the results be applied to the local population?	<input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No
11. Do the results of this study fit with other available evidence?	<input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No
12. What are the implications of this study for practice?	<input type="radio"/> Yes <input type="radio"/> Can't tell <input type="radio"/> No

D. Levels of Evidence

Level	Description	#	Quality Appraisal
3	Cohort Studies	4	85% CASP
4	Single Subject Experimental Design	1	70% JBI
		2	80% JBI
		3	50% JBI
		5	60% JBI
		6	35% JBI

#= Study Number; CASP=Critical Appraisal Skills Programme;JBI=Joanna Briggs Institute

