

Knowledge of attention deficit hyperactivity disorder (ADHD): a comparison of pre-service teachers in primary and special education in Germany

BACKGROUND

Given that the majority of children with attention deficit hyperactivity disorder (ADHD) attend regular classroom settings in Germany, it is necessary for teachers to be well prepared to provide these children appropriate care and education on the basis of accurate knowledge of ADHD. Pre-service teachers should have enough learning possibilities in their curriculum about ADHD. The purpose of this study was to investigate German pre-service teachers' knowledge of ADHD by differentiating between their future school type, their study progress, their learning experiences, gender, and age.

PARTICIPANTS AND PROCEDURE

The participants were 234 pre-service teachers of the University of Leipzig, Germany. The survey instrument constructed by Lee (2015) was slightly modified for pre-service teachers, and consists of the three subscales: (a) characteristics of ADHD, (b) causes of ADHD, and (c) subtypes of ADHD.

RESULTS

Total accuracy of the knowledge of German pre-service teachers was 51.60%, inaccuracy was 21.60%, and no information was 25.80%. German pre-service teachers who majored in special education have a significantly higher accuracy rate than those who majored in primary education.

The knowledge profiles consisting of total knowledge score and three domain-specific subscores can be explained significantly (ANOVAs) by the main effects and the interactions among the independent factors (a) future school type, (b) study progress, (c) experience by curriculum, and (d) personal experience. It was possible to discriminate significantly four pre-service teacher groups (differentiated by future school type and study progress) on the basis of their knowledge profiles by a discriminant analysis.

CONCLUSIONS

Teachers are an important target group for ADHD research because they play a major role in early diagnosis of ADHD as well as supporting their development. During their education, pre-service teachers need to be prepared for dealing appropriately with ADHD children in the classroom. This study provides a basic investigation of German pre-service teachers' needs of learning how to deal with ADHD children.

KEY WORDS

primary education; special education; university curriculum; knowledge accuracy; knowledge of attention deficit disorders scale (KADDS)

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AUTHORS' CONTRIBUTION – A: Study design · B: Data collection · C: Statistical analysis · D: Data interpretation · E: Manuscript preparation · F: Literature search · G: Funds collection

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BACKGROUND

Children in Germany attend the school five days a week, where it is expected to pay attention, listen to the teachers, organize and finish their assigned tasks, and not to disturb the class (American Psychiatric Association, 2013), as well as to perform goal-directed academic activities (e.g., staying seated, completing tasks), and to behave in socially appropriate ways (e.g., controlling impulsivity, not disturbing the class). Unfortunately, children with attention deficit hyperactivity disorder (ADHD) often face their greatest challenges at school. Their difficulties to sustain attention, stay seated, and control impulses often lead to academic (e.g., underachievement), and social (e.g., poor relationships with peers and teachers) problems (Kos, Richdale, & Hay, 2006; Martin, 2014; Taanila et al., 2014). ADHD is commonly observed in German school-aged children (aged 6-18), up to 4.80%. More frequently, primary school children (aged 7-13) are diagnosed with ADHD compared to secondary school children (aged 14-17), and more boys than girls are affected over all age groups (3-17 years: boys: 7.90%, girls: 1.80%) (Schlack, Hölling, Kurth, & Huss, 2007). That means German primary school teachers can meet children with ADHD more frequently than other types of school teachers (e.g., secondary school). This fact is caused by decreasing symptoms with age, hormonal changes, and treatment effects. In Germany, a special school type for ADHD children does not exist, except the ADHD high school in Esslingen. Therefore, these pupils have to be integrated into regular classes. Only very severely disordered ADHD children with learning deficits can be offered the "special school for learning disability" or very severely socially un-adjusted ADHD children (e.g., strong aggressive behavior) can be integrated into the "special school for educational support". That means that primary and special school teachers need an accurate and extensive knowledge basis about ADHD, including school specific teaching management skills.

Teachers as significant persons can give a great help for children with ADHD in the classroom. For example, adults who had ADHD in childhood reported about their overcoming of difficulties through their teachers' professional guidance and care, which acted as a turning point for coping with their disorders (Barkley, 2007). In addition, due to the majority of children with ADHD attending regular classroom settings in Germany, it is necessary for teachers to be well prepared to provide ADHD children appropriate care and education (Murray, 2009; Lee, 2015).

Teachers often recognize behavioral problems of a child with ADHD symptoms and advise the parents to get a professional assessment (Sax & Kautz, 2003). For example, Ohan, Cormier, Hepp, Visser,

and Strain (2008) investigated Australian teachers' knowledge of ADHD and found that teachers with higher knowledge of ADHD encourage parents with children displaying behavioral problems to get a professional assessment, as well as support for these children to adjust at school both academically and socially. Thus, teachers' accurate knowledge of ADHD is one of the important factors for children who potentially have ADHD to adjust in the school setting. Numerous studies have found that if teachers have more accurate knowledge of ADHD, they may have a better understanding of ADHD children and better communication with them (Perold, Louw, & Kleynhans, 2010). This may prevent them from developing negative perceptions and views regarding these children (Arcia, Frank, Sanchez-LaCay, & Fernaindex, 2000; Holz & Lessing, 2002).

In reality, even in-service teachers have a lack of information of ADHD. They may be unable to deal effectively with the needs of these children (Wolraich & DuPaul, 2010), which also concerns pre-service teachers. Pre-service teachers also need to improve their understanding of ADHD. This could help for their future children with ADHD in their classroom to perform better at school, not only academically but also socially, and could strengthen children's resilience and self-esteem, which can positively affect these children's future success (Lee, 2015; Ohan et al., 2008). This can increase pre-service teachers' confidence in teaching and managing children with ADHD in the future classroom, rather than giving up on them.

Teachers' knowledge of ADHD has been investigated mostly in the USA and Australia. For example, Sciutto, Terjesen, and Bender Frank (2000) assessed American primary school teachers' knowledge of ADHD using the Knowledge of Attention Deficit Disorders Scale (KADDS), with a *yes/no* format, in which teachers have 50% chance of guessing the correct answer. This KADDS includes 36 items divided into (a) symptoms and assessment, (b) treatment, and (c) general information, which are currently used for the topic of ADHD (e.g., Kos, Richdale, & Jackson, 2004; West, Taylor, Houghton, & Hudyma, 2005; Kang, Kim, & Yang, 2011; Schmiedeler, 2013). The total score of accurate knowledge of American teachers turned out to be 47.80%. These teachers had higher accurate knowledge regarding primary symptoms (inattention, hyperactivity, and impulsivity) and a lower accuracy level regarding general information of ADHD and treatment. Similar investigations were also conducted in Korea. For example, Kang et al. (2011) assessed Korean elementary school teachers (grade 1-6) regarding their knowledge of ADHD. The total score of accurate knowledge was 53.50%: (a) associated features: 48.90%, (b) symptoms/diagnosis: 59.30%, and (c) treatment: 54.30%. A similar investigation was also conducted by Schmiedeler (2013)

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in Germany. The total rate of knowledge accuracy among German teachers was 54.20%: (a) associated features: 43.90%, (b) symptoms/diagnosis: 72.60%, and (c) treatment: 53.10%.

Whereas numerous studies have investigated in-service teachers' knowledge, only a few studies have investigated pre-service teachers. Given the high prevalence of ADHD, pre-service teachers, particularly for primary schools, will meet children with ADHD in their future classroom (Anderson et al., 2012). Thus, accurate knowledge and trained skills regarding ADHD can help them to feel confident to teach children with ADHD appropriately. In 2004, Bekle investigated Australian in-service and pre-service teachers' knowledge of ADHD, and found that in-service teachers have slightly more but not statistically significantly more knowledge compared to pre-service teachers. In 2004, Kos et al. also investigated knowledge of ADHD among in-service and senior pre-service teachers who majored in primary education. The total accuracy of in-service teachers was 60.70% and of pre-service teachers was 52.60%. More recently, in 2012, Anderson and colleagues found no significant difference between in- and pre-service teachers regarding their knowledge of ADHD. Further, Canu and Mancil (2012) investigated junior and senior pre-service teachers' knowledge of ADHD. They found that pre-service teachers who majored in psychology, biology, and sports science (mean: 60.6%) had higher knowledge compared to students of other disciplines (mean: 54.6%). They also distinguished between lower semester (e.g., freshmen and sophomore) vs. higher grade (e.g., junior and senior). It turned out that pre-service teachers in a higher grade had significantly higher knowledge of ADHD compared to those who were in a lower grade.

Previous studies did not provide clear evidence for the relation between teachers' various experiences and their knowledge of ADHD, even more limited for pre-service teachers. Scitutto et al. (2000) found a positive correlation between the years of teaching experience and teachers' general knowledge of ADHD. However, other studies did not support this result (Kos et al., 2004; Vereb & DiPerna, 2004; Ohan et al., 2008; Schmiedeler, 2013). Nevertheless, another investigation supports the positive relation of the knowledge of teachers and the different stages of their career (Anderson, Watt, Noble, & Shanley, 2012). The results imply that teachers' knowledge of ADHD increases in the course of their professional experience. A reason for the different findings might be that little attention is paid to the quality of teaching experience when the teaching experience is measured only in number of years.

Regarding ADHD-related experience, teaching experience of a child with ADHD seems to be associated with teachers' knowledge of ADHD (Scitutto et al., 2000; Bekle, 2004; Kos et al., 2004). There is also

evidence that the personal experience with ADHD in the family or friends is positively related to the knowledge of ADHD (Schmiedeler, 2013). Thus, contact with affected persons plays an important role for teachers' ADHD knowledge. Different investigations also show that additional ADHD training is positively correlated with ADHD knowledge (Kos et al., 2004; Vereb & DiPerna, 2004; West et al., 2005; Schmiedeler, 2013). These findings lead to the hypothesis that pre-service teachers know more of ADHD if they either have had personal contact with affected persons or if they have learned something about this disorder during their studies.

The purpose of the current study was to investigate German pre-service teachers' knowledge of ADHD by distinguishing between their future school type as well as their study progress. Furthermore, the impact of personal experience with affected persons and of ADHD training during their studies on the knowledge of this disorder was examined.

Regarding four selected independent variables, eight sub-groups were compared: (a) majored in primary vs. special education, (b) lower semester vs. higher grade, (c) with vs. without ADHD experience during university education, and (d) with vs. without personal experience of ADHD. The four dependent variables were related to a) total accurate knowledge score and three domain-specific subscales: b) characteristics of ADHD, c) causes of ADHD, and d) subtypes of ADHD.

Based on theoretical background and the practical implications of the current study, unifactorial and multi-factorial/ivariate methodical approaches were developed and specific hypotheses were derived:

1. Regarding the unifactorial approach:

- Hypothesis 1.1: Pre-service teachers who majored in special education will be more knowledgeable about ADHD than those who majored in primary education (future school type).
- Hypothesis 1.2: Pre-service teachers in a lower grade (1-3 semesters) will be less knowledgeable than those in a higher grade (4-6 semesters) (study progress).
- Hypothesis 1.3: Pre-service teachers who learned skills to manage children with ADHD in their study will be more knowledgeable than those without such experience (experience by university education).
- Hypothesis 1.4: Pre-service teachers with personal experience of ADHD will be more knowledgeable than those without such experience (personal experience).

2. Regarding the multi-factorial/ivariate approach:

- Hypothesis 2.1: The knowledge profiles can be explained by the main effects and the interactions between the independent factors.
- Hypothesis 2.2: On the basis of the knowledge profiles a discrimination of four pre-service teacher groups is possible.

PARTICIPANTS AND PROCEDURE

PARTICIPANTS

Three hundred questionnaires were distributed to the pre-service teachers in the Faculty of Education at the University of Leipzig. Two hundred and thirty four questionnaires were returned and the response rate was 78% (see Table 1).

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SURVEY INSTRUMENT

The first author modified Kos's (2004) questionnaire (English version) to investigate Korean and German in-service teachers' knowledge of ADHD, by conducting a translation/back-translation procedure and item review in order to confirm the equivalence of the survey instrument in different cultures (Lee, 2015). For this study, the two relevant parts (B and F) of the survey instrument (German version) were slightly modified to investigate pre-service teachers' knowledge (Lee, 2015)¹.

Table 1

Description of the sample of German pre-service teachers

Variable	Frequency	%
Gender		
male	27	11.70
female	204	88.30
Age		
18-20	74	31.80
21-25	111	47.60
26-30	43	18.50
31-39	5	2.10
Future School types		
primary education	127	54.30
special education	107	45.70
Study progress		
≤ 3 semesters	141	60.30
≥ 6 semesters	93	39.70
Experience by University Study		
yes	94	41.60
no	132	58.40
Personal experience		
yes	90	38.50
no	144	61.50

Section B (knowledge) of this questionnaire consists of 23 items (e.g., There are a greater number of boys than girls with ADHD). The *true, false, and don't know* format was used (less chance of guessing the correct answer) to differentiate among what pre-service teachers correctly know (2 points), incorrectly know (1 point), and do not know (0 point) about ADHD and children with ADHD. The possible point range was from 23 to 46 points. A higher score corresponded to a higher level of knowledge of ADHD. The internal consistency of Lee's study was .74, which showed more than acceptable internal consistency (more than .60). Section F (pre-service teachers' demographics) consists of six items to measure pre-service teachers' demographic data and ADHD-related experience.

STUDY DESIGN

As independent variables the following were assessed: (a) Future school type of the pre-service teachers (majored in primary vs. special education), (b) Study progress (lower semester vs. higher semester), (c) Experience during university education related to ADHD (with vs. without), and (d) Personal experience of ADHD (with vs. without).

The four dependent variables were related to subscales: (a) characteristics of ADHD, (b) causes of ADHD, and (c) subtypes of ADHD.

DATA COLLECTION

Permission to conduct this study was obtained from the Department of Educational and Rehabilitation Psychology at the University of Leipzig. The survey instrument was distributed to pre-service teachers at the Faculty of Education at the University of Leipzig from April to May in 2014. The second author directly contacted two professors in person from the University of Leipzig to explain the aim of the study and to request cooperation. The data were collected during the lectures. The questionnaire was handed out to pre-service teachers who were willing to participate in this study.

DATA ANALYSIS

SPSS 22.0 was used to analyze the data. First of all, frequency analysis was conducted to confirm the accuracy of the raw data and to correct coding errors. Then descriptive statistics analysis was used to confirm the normality of distribution (skewness/kurtosis and χ^2 test) and to describe the information about pre-service teachers' personal details. Third, regarding the unifactorial approach, *t*-tests were conducted

to test the unifactorial hypotheses with the 5% level of significance. Cohen's effect size (ES) was then calculated. Last, regarding the multi-factorial/ivariate approach, two-way ANOVAs and discriminant analysis were conducted to explore the multifactorial and multivariate determinations.

RESULTS

UNIFACTORIAL COMPARISONS OF GROUP DIFFERENCES REGARDING THE "TOTAL KNOWLEDGE SCORE"

The possible range of pre-service teachers' knowledge was between 23 and 46 points. For this study, the range of German pre-service teachers' knowledge was between 23 to 43 points. The mean of their knowledge was 34.87 ($SD = 3.29$). Table 2 shows how much the pre-service teachers correctly and incorrectly know about ADHD as well as how much they do not know at all (no information) about ADHD. The internal consistency of this study was .62, which was acceptable (more than .60), and the normality of distribution was confirmed ($a3 = -.39$, $a4 = .54$).

Special education pre-service teachers' knowledge of ADHD ($M = 35.81$, $SD = 3.12$) was significantly higher than that of primary education pre-service teachers ($M = 34.07$, $SD = 3.22$; $t(232) = 4.18$, $p < .001$). The effect size was medium ($d = .55$). Therefore, hypothesis 1.1 was accepted (see Table 3).

No significant difference was found between pre-service teachers in a lower grade ($M = 35.07$, $SD = 3.21$)

Table 2

Mean number of items (M) and percentage of correctly known, incorrectly known, and unknown answers

Knowledge	M	%
Correctly known	11.89	51.60
Incorrectly known	4.96	21.60
Unknown	5.93	25.80

Note. The sum of the percentages does not equal 100% and the numbers of items are not 23 due to missing responses.

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and higher grade ($M = 34.56$, $SD = 3.40$; $t(232) = 1.17$, $p = .244$) regarding their knowledge. The effect size was small ($d = .15$) between the two sub-groups. Therefore, hypothesis 1.2 was not accepted (see Table 3).

Pre-service teachers who have learned during their study skills to manage children with ADHD ($M = 35.91$, $SD = 3.18$) showed significantly higher knowledge compared to those without such education ($M = 34.07$, $SD = 3.18$; $t(224) = 4.30$, $p < .001$). It has a medium effect size ($d = .56$). Therefore, hypothesis 1.3 was accepted (see Table 3).

No significant difference was found between pre-service teachers with personal experience of ADHD ($M = 35.33$, $SD = 3.39$), and pre-service teachers without personal experience ($M = 34.58$, $SD = 3.20$; $t(232) = 1.72$, $p = .086$) regarding their knowledge. The effect size between the two sub-groups was small ($d = .23$). Therefore, hypothesis 1.4 was not accepted (see Table 3).

Table 3

Unifactorial approach: Results of the t-tests for all sub-groups

Correctly known	M	SD	t	p	d
Major					
primary education	34.07	3.22	4.18	< .001	.55
special education	35.81	3.12			
Study progress					
≤ 3 semesters	35.07	3.21	1.17	.244	.15
≥ 6 semesters	34.56	3.40			
Experience by University Study					
yes	35.91	3.18	4.30	< .001	.56
no	34.07	3.18			
Personal experience					
yes	35.33	3.39	1.72	.086	.23
no	34.58	3.20			

Note. Knowledge – minimum score was 23 and maximum score was 46; Cohen's effect size (d) = small .20, medium .50, large .80; *** $p < .001$, ** $p < .01$, * $p < .05$.

MULTIFACTORIAL DEPENDENCY OF THE KNOWLEDGE PROFILE ON FUTURE SCHOOL TYPE, STUDY PROGRESS, EXPERIENCE BY THE CURRICULUM AND PERSONAL EXPERIENCE

The main effects of the independent variables “Future school type”, “Study progress in semesters”, “Experience by curriculum” and “Personal experience” and their interactions were analyzed for the dependent variables “Total knowledge”, “Knowledge of characteristics of ADHD”, “Knowledge of causes” and “Knowledge of subtypes of ADHD”.

Significant main effects of the variable “Future school type” on “Total knowledge” ($F(1, 210) = 6.28, p = .013$) and on “Knowledge of characteristics of ADHD” ($F(1, 210) = 8.09, p = .005$) were found. In addition a significant main effect of the variable “Study progress in semesters” on the dependent variable “Subtypes of ADHD” ($F(1, 210) = 3.97, p = .048$) was found. Significant interactions were found between “Future school type” and “Experience by curriculum” on the dependent variables “Total knowledge” ($F(1, 210) = 8.83, p = .003$), “Knowledge of characteristics of ADHD” ($F(1, 210) = 5.89, p = .016$), and “Knowledge of causes” ($F(1, 210) = 5.88, p = .016$). In addition a significant interaction between “Experience by curriculum” and “Personal experience” on the dependent variable “Subtypes of ADHD” was found ($F(1, 210) = 9.30, p = .003$).

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Regarding our multifactorial approach, hypothesis 2.1 was accepted. The knowledge profiles consisting of total knowledge score and three domain-specific sub-scores can be explained significantly by the main effects and the interactions between the independent factors (Future school type, study progress, experience by curriculum, and personal experience). Two-way ANOVAs showed significant knowledge advantages for pre-service teachers for special schools supported by the experience by the curriculum.

MULTIVARIATE DISCRIMINATION OF THE PRE-SERVICE TEACHER GROUPS BY THEIR KNOWLEDGE PROFILES

A discriminant analysis was employed to supplement the results of the simple group comparisons. Discriminant analysis is used to classify or to predict subjects into groups on the basis of the variables under consideration. Therefore, it appears legitimate to use this analysis to identify the “best” set of discriminators for the different pre-service teacher groups.

Since the purpose of this study is to investigate German pre-service teachers’ knowledge of ADHD by distinguishing between their future school type as well as their study progress, these two variables were more carefully assessed by conducting discriminant analysis. Four groups were created: (a) primary education with lower semester, and that of (b) higher semester, (c) special education with lower semester, and that of (d) higher semester.

The results are presented in Figure 1.

The discriminant analysis revealed three canonical discriminant functions and yielded a significant discrimination result. The eigenvalues of the functions were .114 with canonical discrimination function (canonical correlation) of .319, .015 with canonical correlation of .122, and .006 with canonical correlation of .079. The test of functions 1-3 showed a significant result ($\chi^2 = 29.56, df = 9, Wilks \lambda = 0.88, p = .001$). The structure matrix of pooled within-groups correlations revealed that the major discriminating variables between the four groups are the dependent variables “Knowledge of characteristics of ADHD” (.955), “Total knowledge” (.833), and “Knowledge of causes” (.783). Thirty-five and fifty one-hundredths percent of original grouped cases were correctly classified, and a similar level of classification (31.60%) was found by cross-validated grouped cases.

Regarding our multivariate approach, hypothesis 2.2 was accepted. It was possible to discriminate significantly the four pre-service teacher groups (differentiated by future school type and study progress) on the basis of their knowledge profiles.

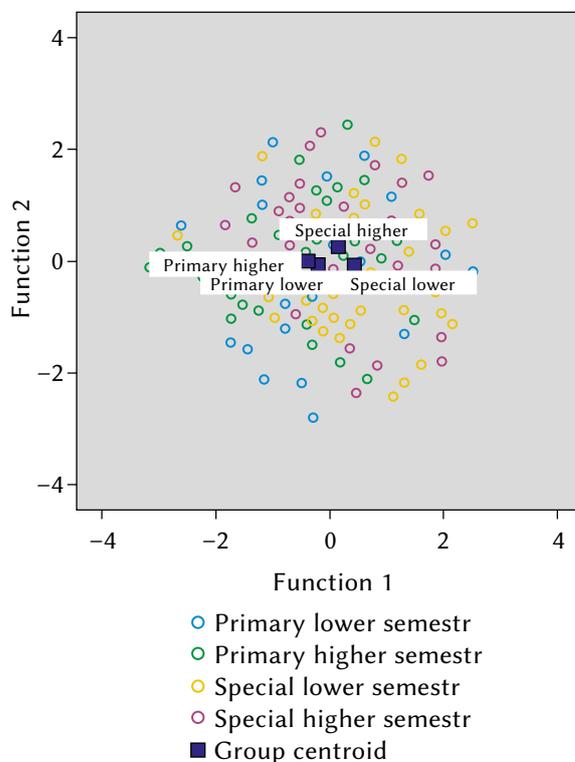


Figure 1. Discriminant analysis: Pre-service teachers (differentiated by future school type and study progress) discriminated by their knowledge profiles.

DISCUSSION

This study aimed to investigate German pre-service teachers' knowledge of ADHD by differentiating between their future school type and their study progress. Furthermore, the impact of personal experience with affected persons and ADHD training during their studies on the knowledge about this disorder were examined.

PRE-SERVICE TEACHERS' KNOWLEDGE OF ATTENTION DEFICIT HYPERACTIVITY DISORDERS

The participants in this study answered 51.60% of the statements about ADHD correctly. They had misconceptions about 21.60% of the statements and they were uncertain about 25.80% of the statements. A different pre-service teacher sample from an earlier study achieved 52.60% correct answers (Kos et al., 2004). This result is similar to what we found. The results of Kos et al. (2004) and Schmiedeler (2013) showed that in-service teachers have more knowledge of ADHD than pre-service teachers (Bekle, 2004; Anderson et al., 2012).

The item which was answered correct most often by pre-service teachers of this study was that "children from every social class can suffer from ADHD". This result matches what Kos et al. (2004) found. Another common correct answer was that "both girls and boys are equally affected by ADHD". Thus, the pre-service teacher sample has no prejudice against ADHD students regarding their social status or gender.

The most common misconception in this investigation was that "ADHD cannot be diagnosed if a child does not suffer from hyperactivity". However, ADHD can be diagnosed if a child only fulfills the criteria of inattention (American Psychiatric Association, 2013). Unlike this result, in-service teachers showed good knowledge of the core symptoms of ADHD in earlier studies (Sciutto et al., 2000; Schmiedeler, 2013). It is very important that teachers have fundamental knowledge of ADHD symptoms, because they are typically the first persons who notice behavioral disorders in children and who advise further examination (Sax & Kautz, 2003). Besides, teachers often serve as an information source for diagnosing ADHD (Vereb & DiPerna, 2004), which requires that the teachers interpret students' behaviors correctly.

In summary, it can be concluded that the pre-service teachers of the University of Leipzig have a moderate knowledge of ADHD. But, the results suggest that they need further training about ADHD. This conclusion is emphasized due to the fact that 97% of the students wanted this additional training.

INTERPRETATION OF THE RESULTS

The first hypothesis (1.1) regarding the unifactorial approach was that German future special education teachers know more about ADHD than future primary school teachers. While the future special education teachers on average answered 13 out of 23 statements about ADHD correctly, the future primary school teachers answered 11 of the statements correctly. The difference between these two groups was significant, which confirms the first hypothesis. Consequently, the future special education teachers seem to learn more about behavioral disorders during their studies than the future primary school teachers.

The second hypothesis (1.2) was that German pre-service teachers who are at a further study stage know more about ADHD than students who have just started their studies. This hypothesis could not be confirmed. Possible explanations for this result are that ADHD was discussed at the beginning of the study and the students were not able to remember what they had learned over a longer period.

This results confirmed the next hypothesis (1.3). If ADHD is discussed during the study of pre-service teachers, then they know more about this disorder than if it is not discussed. This is in line with previous research which found that practicing teachers know more about ADHD if they participated in additional training regarding ADHD (Kos et al., 2004; Schmiedeler, 2013; Vereb & DiPerna, 2004; West et al., 2005). To ensure that pre-service teachers have accurate knowledge of ADHD, it is important that they learn the most important facts about it during their education. Better results can be expected by practical training of management skills during the teacher study.

There was no evidence for the following hypothesis (1.4), which stated that pre-service teachers know more about ADHD if they have had personal contacts with affected persons. This result is not consistent with Schmiedeler (2013).

In addition, as hypothesis 2 proved that, the results indicate that future special education teachers know more about ADHD than future primary school teachers and that students know more about this disorder if it is discussed during their education.

LIMITATIONS

The results are not transferable as all participants were students of the University of Leipzig. It would be necessary to survey students from different universities. Also, the sample size was not satisfactory. We collected more data from students who were at the beginning of their studies compared to students who had already reached the sixth semester. This was especially a problem for recruiting future special education teachers. Another problem regarding

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the sample of future special education teachers concerns the curriculum. While the students who were at a further study stage attended a master's degree course, the beginning students attended a course for which the aspired degree was the "State examination". This might have contributed to the fact that we did not find a significant difference in ADHD knowledge between beginning students and students who were at a further study stage.

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CONCLUSIONS

Students who aim to become a special education teacher learn more about ADHD during their studies. It seems to be necessary to integrate more information and training about ADHD into the curriculum for future primary school teachers. In addition, it is important to note that in both groups of pre-service teachers many questions were answered incorrectly or with "I don't know". Thus, both groups require additional training regarding ADHD. Future research should focus in more detail on the different school types. For example, it could be tested if there are interactions between prospective school type and study progress. Furthermore, secondary school and high school teachers should be investigated as they can also be confronted with affected pupils in the classroom.

The results of this study also show that German pre-service teachers know more about ADHD if they learn something about it during their studies. This matches previous research which showed that teachers know more about ADHD if they have attended additional ADHD training (Kos et al, 2004; Vereb & DiPerna, 2004; West et al., 2005; Schmiedeler, 2013). The majority of pre-service teachers in this present study stated that they had not learned anything about ADHD during their studies. It is very important that they gain more knowledge of ADHD during their education. Future research should focus on the quality of ADHD training. Such evidence could be helpful for implementing seminars on ADHD in the university context or for implementing additional training for in-service teachers.

Teachers are an important target group for ADHD research since they play a major role in early diagnosis of ADHD and in promoting affected children. During their education teachers need to be prepared as best as possible for dealing appropriately with ADHD children in the classroom. This study provides the basis for investigating German pre-service teachers' needs in learning how to deal with children affected by ADHD.

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ENDNOTES

1 If you wish to access the full questionnaire, contact the first author: yumi.lee@uni-leipzig.de.

REFERENCES

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Association.
- Anderson, D. L., Watt, S. E., Noble, W., & Shanley, D. C. (2012). Knowledge of attention deficit hyperactivity disorder (ADHD) and attitudes toward teaching children with ADHD: the role of teaching experience. *Psychology in the Schools, 49*, 511-525.
- Arcia, E., Frank, R., Sanchez-LaCay, A., & Fernández, M. C. (2000). Teacher understanding of ADHD as reflected in attributions and classroom strategies. *Journal of Attention Disorders, 4*, 91-101.
- Barkley, R. A. (2007). School interventions for attention deficit hyperactivity disorder: Where to from here? *School Psychology Review, 36*, 279-286.
- Bekle, B. (2004). Knowledge and attitudes about attention-deficit hyperactivity disorder (ADHD): A comparison between practicing teachers and undergraduate education students. *Journal of Attention Disorders, 7*, 151-161.
- Canu, W. H., & Mancil, E. B. (2012). An examination of teacher trainees' knowledge of attention-deficit/hyperactivity disorder. *School Mental Health, 105-114*.
- Holz, T., & Lessing, A. (2002). Reflections on attention-deficit hyperactivity disorder (ADHD) in an inclusive education system: research paper. *Perspectives in Education, 20*, 103-110.
- Kang, K.-R., Kim, Y.-H., & Yang, Y.-O. (2011). Teaching status and knowledge of elementary school teachers of children with attention deficit hyperactivity disorder. *Journal of Korean Academy of Child Health Nursing, 17*, 136-144.
- Kos, J. M. (2004). *Primary school teachers' knowledge, attitudes, and behaviours toward children with Attention-Deficit/Hyperactivity Disorder* (Unpublished doctoral dissertation). RMIT University, Melbourne, Australia.
- Kos, J. M., Richdale, A. L., & Hay, D. A. (2006). Children with attention deficit hyperactivity disorder and their teachers: A review of the literature. *International Journal of Disability, Development and Education, 53*, 147-160.

- Kos, J. M., Richdale, A. L., & Jackson, M. S. (2004). Knowledge about attention deficit/hyperactivity disorder: A comparison of in-service and pre service teachers. *Psychology in the Schools, 41*, 517-526.
- Lee, Y. (2015). *Teachers' attitudes, knowledge, and classroom management strategies regarding students with ADHD: A cross-cultural comparison of teachers in South Korea and Germany* (Unpublished doctoral dissertation). University of Leipzig, Leipzig, Germany.
- Martin, A. J. (2014). The role of ADHD in academic adversity: Disentangling ADHD effects from other personal and contextual factors. *School Psychology Quarterly, 29*, 395-408.
- Murray, E. (2009). "Don't give up on them": *Managing attention deficit hyperactivity disorder in schools – what teachers and parents believe and know* (Unpublished doctoral dissertation). Murdoch University, Perth, Australia.
- Ohan, J. L., Cormier, N., Hepp, S. L., Visser, T. A. W., & Strain, M. C. (2008). Does knowledge about attention-deficit/hyperactivity disorder impact teachers' reported behaviors and perceptions? *School Psychology Quarterly, 23*, 436-449.
- Perold, M., Louw, C., & Kleyhans, S. (2010). Primary school teachers' knowledge and misperceptions of attention deficit hyperactivity disorder (ADHD). *South African Journal of Education, 30*, 457-473.
- Sax, L., & Kautz, K. J. (2003). Who first suggests the diagnosis of attention deficit/hyperactivity disorder? *Annals of Family Medicine, 1*, 171-174.
- Schlack, R., Hölling, H., Kurth, B.-M., & Huss, M. (2007). Die Prävalenz der Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS) bei Kindern und Jugendlichen in Deutschland. Erste Ergebnisse aus dem Kinder- und Jugendgesundheitssurvey (KiGGS) [The prevalence of ADHD in children and adolescents in Germany. First results from the child and adolescents health survey (KiGGS)]. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz, 50*, 827-835.
- Schmiedeler, S. (2013). Wissen und Fehlannahmen von deutschen Lehrkräften über die Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS) [German teachers' knowledge and misperceptions about ADHD]. *Psychologie in Erziehung und Unterricht, 60*, 143-153.
- Sciutto, M. J., Terjesen, M. D., & Bender Frank, A. S. (2000). Teachers' knowledge and misperceptions of attention-deficit/hyperactivity disorder. *Psychology in the Schools, 37*, 115-122.
- Taanila, A., Ebeling, H., Tiihala, M., Kaakinen, M., Moilanen, I., Hurtig, T., & Yliherva, A. (2014). Association between childhood specific learning difficulties and school performance in adolescents with and without ADHD symptoms: a 16-year follow-up. *Journal of Attention Disorder, 18*, 61-72.
- Vereb, R. L., & DiPerna, J. C. (2004). Teachers' knowledge of ADHD, treatments for ADHD, and treatment acceptability: An initial investigation. *School Psychology Review, 33*, 421-428.
- West, J., Taylor, M., Houghton, S., & Hudyma, S. (2005). A comparison of teachers' and parents' knowledge and beliefs about attention-deficit/hyperactivity disorder (ADHD). *School Psychology International, 26*, 192-208.
- Wolraich, M. L., & DuPaul, G. J. (2010). *ADHD diagnosis and management: a practical guide for the clinic and the classroom*. Baltimore, MD: Brookes Publishing.