



AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: <http://www.aensiweb.com/AEB/>

Investigating the Relationship between the Developmental Levels of Theory of mind and Inhibition in Children with Attention Defect / Hyperactivity Disorder Syndrome

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ARTICLE INFO

Article history:

Received 18 July 2014

Received in revised form 27 August 2014

Accepted 12 October 2014

Available online 3 November 2014

Keywords:

attention defect/hyperactivity disorder syndrome, inhibition, theory of mind

ABSTRACT

The relationship between theory of mind and inhibition is one of the controversial issues which has resulted in contradictory research results. The present research was conducted to investigate the relationship between the developmental levels of theory of mind and inhibition in 7 to 9-year old kids with attention defect/hyperactivity disorder syndrome in normal schools. The research sample includes 120 kids with attention defect/hyperactivity disorder syndrome chosen through multi-step cluster sampling. The following tools were used in this research: attention defect/hyperactivity disorder syndrome diagnosis criteria questionnaire (based on DSM-IV), the developmental test of theory of mind (the 38-question form) and colorful Raven's test and the subscale of regulating mind pictures and kids' revised Kelsler. Statistical tests including Kolmogorov-Smirnov test, Spearman's correlation and regression analysis were utilized. The results of this study indicated a no significant relationship between the developmental level of theory of mind and inhibition in kids with attention defect/hyperactivity disorder syndrome ($P > 0.5$). Conclusion: despite having damages in inhibition, children with attention defect/hyperactivity disorder syndrome have a natural performance in theory of mind. Thus, this ability can be used to improve the social relationship of these children.

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To Cite This Article: Nasrollah Veysi, Hamid Alizadeh, Nasram Shayan, Khalil Aryanfar, Investigating the Relationship between the Developmental Levels of Theory of mind and Inhibition in Children with Attention Defect / Hyperactivity Disorder Syndrome. *Adv. Environ. Biol.*, 8(12), 1232-1238, 2014

INTRODUCTION

Attention defect and hyperactivity disorder syndrome are some of the most common psychological and neuro-developmental disorders in childhood period which usually last till adulthood [38] and cause problems in various aspects of educational, family and social life of the individual [42]. Among the apparent features of this disorder, one can point to problems in concentration, constant attention disorder, distraction, weakness in controlling impulses, weakness in planning and organization and restlessness [46]. Those afflicted with this disorders visit therapeutic and consulting centers more than any other disorders (Roy, 2014). The identification and statistical guide to psychological disorders – fourth edition – revises its text (DSM-IV-TR) and describes three subgroups for this disorder: mostly inattentive, mostly hyperactive and compound (a mixture of two subgroups of hyperactive and attention defect). In order to identify attention defect/hyperactivity disorder syndrome, the symptoms must be chronic and observed at least twice before the age of 7. Today, the results of the researches agree on this issue that this disorder is not merely an attention disorder, but this disorder is caused by the malfunction of brain circles especially in the inhibition unit. This disorder disrupts other important functions of the brain which are necessary for concentrating attention. Inhibition is one of the components of executive and procedural function of the neurology which helps children respond hesitantly. Behavioral inhibition includes three interrelated procedures: A) primary response inhibition which includes the response that follows from the immediate bolstering or that which was evoked by such a response. B) stopping the current response, in this way, it will be possible to hesitate to make decisions for creating response, and C) retaining the self-directed hesitations and responses which prevents similar responses and incidents [5]. Barkly (1997)

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believes that all the problems experienced by children with attention defect/hyperactivity disorder syndrome are the result of their disability in prohibiting their behaviors. He believes that damages caused to inhibition functioning will influence the 4 executive functions such as working memory, inner speech, rebuilding and autonomy of motivation and emotion and, as a result, the function of autonomy will be damaged. Barkly believes that attention defect in these kids is the result of problems in interaction with executive functions. This interaction of behavior is controlled through inner represented information (especially mental imagination, rules and self motivation). Controlling the intervention which is one of the functions of inhibition plays a major role in strengthening and boosting the purposeful behavior which Barkly believes to be the same as constant attention. In this respect, attention defect is a sort of secondary consequence caused through disorders in executive functions. In other words, damages to behavioral inhibition and weak control prevent effective autonomy and impulsive behaviors are demonstrations of such condition [5]. One of the claims made by Vigotsky and, generally, all socio-cultural theories is that development or growth takes place in social interaction. Concerning the social interactions of children with attention defect/hyperactivity disorder syndrome, it is proved that these children have difficulty in interacting with their peers [44]. Based on the definition of the theory of mind as an ability to predict and describe others' and one's own behaviors [20], we may accept this assumption that "the theory of mind is necessary to establish interaction with others". The researches have also confirmed this view and it is proved that theory of mind is associated with issues such as acceptance by peers, social merit and deserve [13] and social behavior [32].

In the literature of the research, synonyms such as mentalization, mind reading, folk psychology and social understanding are also used in place of theory of mind. Theory of mind attitude is the last research trend about the development of cognition in children which is the dominant module of study in this field [26]. Over the last 2 decades, researches on the theories of the children's mind have been widely common. As a matter of fact, March Brenshtain the editor in chief of the research magazine "Child development" stated that half of the researches associated with cognitive development in United States is about the theory of mind [12]. Flavel and Miller [26] believe that theory of mind researches based upon realization of mental states are the centroid of the researches conducted in the field of cognitive developments.

Theory of mind in the exceptional children: among the exceptional children, Autistic children are the most prominent group which have dedicated the highest portion of researches in the field of theory of mind to themselves. In this respect, Barron-Kohn [14] claimed that damages to the theory of mind are the especial feature of autistic children. However, researches and studies conducted in other exceptional groups did not support this view and rejected this claim, for example Porter and Koolit [41] in people with Williams syndrome, Tearion and Nader-Gress Boyce (2008) in mentally retarded children, Cornish *et al* [18] in children with fragile X syndrome, Peterson and Wellman and Lio [41] in deaf children, and Peterson Web (2000) in blind children showed that these children have defects or hesitations in theory of mind. However, conditions are different in children with attention defect/hyperactivity disorder syndrome, firstly because few foreign researches have been conducted in this field which are less than the fingers in one hand [50], secondly as far as the researcher knows, few domestic researches have been conducted in this field in Iran, thirdly the results of these few foreign researches are not in line with one another. Thus considering the lack of such a research in this field, the present research was conducted to investigate the relationship between the developmental levels of theory of mind and inhibition in children aging 7 to 9 with attention defect/hyperactivity disorder syndrome in usual schools.

Research methodology:

Based on the goals of this research, the present study is a correlational research. The goal of this research is to map the relationship between variables. Of course, the presence of a correlation between variables does not mean that one variable is the result of the other one [19]. The study population of this research included all the 7 to 9-year old normal students in Tehran which were studying in the elementary level. Through multistage cluster sampling in these schools, 120 students with attention defect/hyperactivity disorder syndrome were selected according to the criteria presented in the fourth edition of diagnosis and statistical criteria guides to psychological disorders of APA (2000) and participated in the study after gaining the consent of their families.

Tools and methods:

Questionnaire for diagnosing attention defect/hyperactivity disorder syndrome: this questionnaire was prepared by the APA (2000) and includes 18 questions which evaluate the above-mentioned disorder in terms of three subgroups. It is arranged in yes/no format and a score of 6 or above 9 shows a disorder in each type. The validity of this test in Iran was reported to be 93% through calculation of Cronbach's alpha [35].

Theory of mind: the data associated with the theory of mind were gathered through the 38-question test of theory of mind. This test is designed based upon a developmental and multidimensional view of theory of mind and evaluates a relatively larger range and more complicated and advanced levels of theory of mind. This test has the following three subscales:

1- the first subscale: “introductory theory of mind”, meaning first level theory of mind or re-identification of emotions and representations including 20 questions. 2- the second subscale: “the initial statement of a real theory of mind”, meaning second level theory of mind or the wrong initial believes and understanding the wrong belief including 13 questions. 3- Third subscale: “more advanced aspects of the theory of mind”, meaning third level theory of mind or understanding the secondary wrong belief or joke including 5 questions [28]. To investigate the validity of this test, content validity method, micro-correlation, total score test and simultaneous validity were utilized. The simultaneous validity was measured to be around 0.89 through the correlation of the test and the assignment of the dull’s house which was significant in the one-hundredth level. The correlation coefficient of the micro tests with the total score of the test is also significant in all cases and ranges from 0.82 to 0/96. The validity of the test was studied through the three methods of re-test, Cronbach’s alpha and validity of scorers. The validity of research ranged from 0.70 to 0.94 and all coefficients were significant in the level of one-hundredth. The internal stability of the test was calculated through Cronbach’s alpha for the whole test and each micro test to be 0.86, 0.72, 0.80, and 0.81 respectively. The validity coefficient of the scorers was also calculated to be 0.98 [28]. This test was administered individually and included pictures and stories and questions were asked after they were offered to the participants. Each right answer received a value of 1 and wrong answers received a value of 0. On the whole, the participants received a score from 0 to 38.

Inhibition: Dawson & Guare [5] believe that the micro test of regulating mental images and revised Veksler of Children can be utilized to measure the inhibition. The subscale of regulation test includes 53 cards with pictures on them. Each sequence of the pictures present a story and totally make 13 series of stories [34]. After the necessary trainings in this test, the revised Veksler’s test was administered for kids according to the instructions. To score this scale, both the time and the story presented are scored.

In order to determine the simultaneous validity, Shahim [45] has compared this scale with the pre-elementary scale of Veksler and the correlations coefficients between verbal, non-verbal and total anesthesia were calculated to be around 0.84, 0.74 and 0.85 respectively which are close to the coefficients reported in the booklet of the main scale. The validation coefficient is calculated both through retest and halving. The validation coefficient was calculated through halving for the verbal and non-verbal micro tests using Spearman-Brown corrected correlation coefficient which ranged from 0.42 to 0/98 and the mean of the coefficients was 0.69. The validity coefficient of the above-mentioned test was calculated in six age groups between 6 to 12 years old in the distance of 4 to 6 weeks between the first and second administration which ranged from 0.44 to 0.94. The mean of the validation coefficient was also 0.73.

Interviewing parents: as diagnosis of attention defect/hyperactivity disorder syndrome requires criteria in at least 2 different environments, thus diagnosis questionnaires were also given to parents after teachers. Then, data concerning the socio-economical status, parents’ level of literacy and the number of brothers and sisters were also collected.

Colorful Raven’s test: to ensure that there is no difference among groups in terms of the IQ, this test was administered among children who were diagnosed with attention defect/hyperactivity disorder syndrome and the results did not indicate any significant difference.

This research was conducted in the academic year 2010-11 on the elementary students of Tehran. First the necessary permissions and documents were obtained from the bureau of education and training of the district, then arrangements were made with the managers and authorities of the school. Then, parents were called to get permission for the participation of their kids in the test. First, the diagnosis questionnaire was distributed among teachers based upon the criteria of (DSM-IV), then after identification of the students with attention defect/hyperactivity disorder syndrome, the very same questionnaire were distributed among their parents. Then, colorful Raven’s questionnaire for kids was used to evaluate the IQ of these students. Next, the students who were not suitable for the test were discarded and the remaining students were sent to a separate room in the school and took Veksler’s 38-question intelligence for kids individually and according to the instructions of the test. Then, the answers were written on the answer sheets.

Results:

Table 1: normal investigation of age, levels of theory of mind and inhibition (k-s)

variable	mean	standard deviation	Z statistics	level of possibility
age	7.98	0.82	1.58	0.13
inhibition of the first level	19.60	0.60	2.68	0.00
inhibition of the second level	12.50	0.67	2.61	0.00
inhibition of the third level	4.58	0.60	2.79	0.00
theory of mind	2.44	0.76	1.76	0.00

The numbers in table (1) show that the age of the participants in normal with the possibility value of (0.13), yet first, second and third level theories of mind are not normal with the possibility value of (0.00).

Table 2: Prediction of inhibition based on the theory of mind.

predictive variable	correlation coefficient	determination coefficient	standardized beta value	possibility
first level inhibition	0.080	0.006	0.80	0.582

The numbers in table (2) show that the first level of inhibition with the possibility of (0.582) is incapable of predicting the inhibition changes.

Table 3: Prediction of inhibition based on the theory of mind.

predictive variable	correlation coefficient	determination coefficient	standardized beta value	possibility
first level inhibition	0.040	-0.019	0.040	0.785

The numbers in table (3) show that the second level theory of mind is incapable of predicting inhibition changes with the possibility of (0.758).

Table 4: Prediction of inhibition based on the theory of mind.

predictive variable	correlation coefficient	determination coefficient	standardized beta value	possibility
first level inhibition	0.055	-0.018	0.055	0.706

The numbers in table (4) show that the third level theory of mind is incapable of predicting inhibition changes with the possibility of (0.706).

Table 5: Correlations between levels of theory of mind and inhibition

inhibition possibility	first level inhibition	second level inhibition	third level inhibition
value	0.10	0.74	0.10
correlation coefficient	0.49	0.04	0.46

As it is seen in table 1, theory of mind and inhibition are not normal, thus Spearman's correlation is used to investigate the question if there is a relationship between levels of theory and inhibition. The numbers in table 5 show no significant relationship between the inhibition levels (first, second and third levels) and inhibition. The first level with the possibility of 0.10 and the correlation coefficient of 0.49, the second level with the possibility of 0.74 and the correlation coefficient of 0.04 and the third level with the possibility of 0.10 and the correlation coefficient of 0.46 have no relationship with theory of mind.

Discussion and conclusion:

Theory of mind is a cognitive factor that help us report our propositional attitudes, attribute them to others and use these certain and observed states to predict and explain behaviors. While we are interacting with another individual, we create a mental pattern of how people think and feel. In this research, we sought to see if there was any relationship between the developmental levels of theory of mind and inhibition in children with attention defect/hyperactivity disorder syndrome. The results indicated no significant relationship between these 2 factors. The results of this research were not in line with the results of the study conducted by Buttillaar, Vavde we [15]. In a research titled theory of mind and identification of the emotions in the autistic children where half of the control group was formed by children with attention defect/hyperactivity disorder syndrome, they arrived at the conclusion that performance of the students with attention defect/hyperactivity disorder syndrome is significantly worse than the other group in assignments of the theory of mind. On the other hand, the research conducted by Charman, Carrol & Sturg [16] on 22 kids in the range of 6 to 10 with attention defect/hyperactivity disorder syndrome and 22 normal kids conducted with the goal of investigating the relationship between theory of mind, executive functions (inhibition, working memory and planning) and social merit yielded other results. They found no difference between normal kids and those with this disorder in doing the assignments of the theory of mind and children with attention defect/hyperactivity disorder syndrome have a natural performance in doing the assignments of the theory of mind. This incongruence in results may be due to several factors: first, different assignments and tests are used to measure the theory of mind. Researches have shown that certain types of the assignments of the theory of mind are more difficult than other assignments. Second, these researches have been conducted in different cultures and researchers have shown cultural differences are prominent in development of the theory of mind [51], third in some of these researches, the sample of the kids with attention defect/hyperactivity disorder syndrome was very limited and used as the comparison group. Fourth, in some of the researches, children with attention defect/hyperactivity disorder syndrome also had simultaneous disorders which could influence the results of the study. Fifth, the groups who had participated in this research were not of the same age, while the researches have shown that as children move from the age of 3 to older ages, their performance in doing the assignments of the theory of mind improves. Another research whose results were much in line with the results of this research is the research by Perner, Kain & Brachfeld [40] about the relationship between theory of mind and executive functions in children aged 6 to 10 who are exposed to attention defect/hyperactivity disorder syndrome. They arrived at the

conclusion that these kids, in spite of their weak performance, show no damage in the advanced assignments of the theory of mind such as understanding jokes and lies, thoughts and the mental states of others. They believed that these kids can have a healthy theory of mind in spite of the damages to their executive functions. In another research conducted by Happe & Frit [31] on children with attention defect/hyperactivity disorder syndrome and their comparison with normal children, they realized that these kids act like normal kids in doing the assignments of the theory of mind and no difference is observed between these groups in doing the assignments and their results are in line with those of this research. The results can be summed up as follows: since damages caused to the inhibition of these kids can influence their natural performance in doing the assignments of the theory of mind and since children with attention defect/hyperactivity disorder syndrome have difficulties in their social interactions and the theory of mind is a key component for successful social interaction, we can say that children utilize this ability to improve their social behavior. Humans can use theory of mind to attribute certain propositional attitudes to others and predict and interpret their behaviors. These kids can also utilize theory of mind through referring to invisible mental states to interpret obvious behaviors and improve their social behaviors. Without the theory of mind, these kids are unable to fool and cheat on each other and damages to this cognitive ability causes problems in most of the important social performances such as the social and educational performance of these children. Thus, the following recommendations are put forward: A) developmental structures such as social cognition, theory of mind and social understanding must be studied carefully considering the maximum variables involved in these children. B) more attention should be paid to the psychological interventions in the process of the clinical diagnosis and treating these children. C) the presence of the absence of damage to theory about children with attention defect/hyperactivity disorder syndrome is not accepted by all the researchers and clinical researchers. Thus concerning the lack of researches in this field and due to cultural difference in theory of mind, it is recommended that theory of mind be studied in the students with attention defect/hyperactivity disorder syndrome of other races.

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