

## Role of Age, Siblings Verbal and Nonverbal Ability in Development of the Theory of Mind in Intellectually Disabled Students

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Article information	Abstract
<p>Article history: Received: 27 May 2012 Accepted: 4 July 2012 Available online: 1 Jan 2013 ZJRMS 2014 Sep; 16(9): 59-63</p> <p>Keywords: Theory of mind Intellectual disability Verbal and non-verbal abilities</p> <p>*Corresponding author at: Department of Social Work, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. E-mail: relicfir@yahoo.com</p>	<p><b>Background:</b> The purpose of this study is to investigate theory of mind development (TOM) with regard to mental retarded students (MRS) and its relationship with verbal and non-verbal abilities, and number of siblings.</p> <p><b>Materials and Methods:</b> This study is a cross-sectional, for all male mental retarded students, age of 8 to 14 years (about 59 individuals) which were from the city Torbat-e Heidarieh, Iran. Unexpected-content task (UCT) and 38-items test were used for measuring TOM. Also, the Wechsler Intelligence Scale for children Revised (WISC-R) was used to examine the verbal and non-verbal abilities. Information of siblings was established in an interview with the parents, also by looking at the students' ID cards. In order to analyze data, ANOVA, Scheffe, Pearson correlation coefficient and chi-square were carried out.</p> <p><b>Results:</b> First and second level theory of mind development with regard to intellectually disabled students were ascending to 12 years age (<math>p&lt;0.05</math>) and then maintained stable (<math>p=0.87</math>). However, theory of mind development that measured by Unexpected Content Task (UCT), was always ascending (<math>p&lt;0.05</math>). The verbal ability had a positive and significant correlation with first (<math>p&lt;0.001</math>) and second level (<math>p&lt;0.001</math>) theory of mind, while non-verbal ability had a positive and significant correlation with both first (<math>p&lt;0.009</math>) and second level (<math>p&lt;0.001</math>). Number of siblings had not been significantly correlated with theory of mind development which related to intellectually disabled students (<math>p&gt;0.05</math>).</p> <p><b>Conclusion:</b> Altogether, the things "theory theory" and "modular" approaches state might be acceptable. Those theories which are based on sociocultural approaches expressing experiment of communication underlies mind understanding development must be more examined.</p> <p>Copyright © 2014 Zahedan University of Medical Sciences. All rights reserved.</p>

### Introduction

In recent years, child researchers have been more and more interested in issues like children's social cognition. Ability of social cognition consists of several constructs, most of all, notably Theory of Mind (ToM). ToM is a concept referring to how a child predicts and describes behavior of others with the help of mental states [1]; ToM is a key element in human relationship and might be a unique ability to interpersonal function. This might be very important, especially for children with intellectual disability. Intellectually disabled children are recognized to have difficulty in social communication. In their study on ToM for intellectually disabled children, Abbeduto et al. [2] reported that problem of making a good relationship, might be a result from lack of ToM. So then, this finding, along with the other researches that indicate a linkage between social communication and psychological problems lead us to the fact that ToM among this group of children must be deeply investigated and so, more knowledge about the development pattern should be gathered. Various theories have been developed in order to explain the ways a child can understand his/her mind and mental states. For example, "theory-theory" approach believes that ToM development requires for key

processing to be complete [1]. To explain why 5 years old could manage to solve false belief tasks while 3 years old are unable to do so, Ruffman et al. [3] say that this may be related to limited concepts that they know in comparison with the first group. Other theories which base on socio-cultural approaches, focus on amount of contact experiences that a child may have. They express that communicating with others is where ToM begins; so that, those children who have experience of talking with the members of family, show better performance in ToM tasks, because they have more chances to learn about other people [4]. Brown et al. [5] explain that children broadly apply mental states in contact with their siblings rather than their parents. On the basis of this claim, some researchers assumed that more number of children in the family would result in more success for the child to respond to ToM task. Roffman et al. [3] considered older brothers and sisters as the sources of mental states. McAlister and Peterson [6, 7] found the same results with sibling in close ages. "Modular" approach searches general abilities like understanding of information processing, capacity of working memory [8] and executive function [6, 9, 10] from which ToM

development originates [11]. Some research has surveyed the relationship of ToM with intelligence and showed different results. Adab [12] reported absence of such relationship in normal children. Happe [13] didn't find any association between ToM and verbal and nonverbal abilities in intellectually disable individuals. Some research suggested that ToM was positively related with verbal abilities but there was no relationship between ToM and nonverbal abilities [14]; even though, later studies found significant relationship between these variables [7, 15, 16]. These inconsistencies might root in different instruments used to assess ToM. Research shows that some types of ToM tasks (e.g. unexpected transfer task rather than UCT) are harder to pass [12, 17]. In addition, according to Vinden [18] local culture might be an important item in the field of ToM; so different findings could be simply attributed to different cultures. The present study was taken place in Iran, a different cultural context from the research mentioned above. Here, we were trying to find out how ToM develops, with regard to the instrument, and whether ToM development of Persian IDs is related to their verbal and non-verbal abilities and also to the number of siblings.

## Materials and Methods

**Participants:** In this cross-sectional study, all male 1st to 5th grades ID students in the range of 8 to 14 years old, enrolled in Mia'ad education center (the only center for this group of boys in Torbat-e-Heidarieh, a city in the east of Iran) were included. The whole number of the population was 80, but 21 individuals were excluded. Only those children remained in the study who could meet the inclusion criterion, as followed: Since previous studies have exhibited that autism and speech disorders (like expressive communication disorder) could affect ToM development [2], those who had such problem became ignored in the analysis.

None of the participants should have not had fragile X nor Williams or syndromes like them. The participants must have been enrolled in the center along the period of study. IQ of the participants was in the range between 50 to 70.

**Instruments:** Data were collected by means of: 1. Unexpected Content Task (UCT), 2. 38-item ToM test 3. Wechsler Intelligence Scale for children Revised (WISC-R) and finally, 4. Interview with the mothers in order to ensure the sibling's personal information. Unexpected Content Task (UCT): this task was designed by two Australian psychologists, Perner & Wimmer [17]. In the task, examiner shows a box to the child (e.g., match box) of which common content can be conjectured by looking at the shape, but there is something else like a match in it. Then s/he asked the child to guess the content. If the answer is correct, the examiner would open the box, but the child would see different content, something like, say, eraser. Then close it again and ask the child: "what do you think Albert would say if I show the box to him?" and after that, one additional question will be asked about

their primary belief to the box content. Correct response to both questions will be scored "1", and incorrect answers will scored "0". Mark "1" shows ToM attainment and "0" indicates inability to attain. This task is based on a traditional view that says correct answers to false belief tasks (e.g. unexpected content and unexpected transferring) indicate TOM attainment. Validity of this task is identified by age distinction, so that children in the age 4 or below are unable to answer whereas older children can do it correctly. 38-item TOM test: original form of this test was designed by Muris and colleagues [20]. This test is created upon a development and multi-dimensional view to ToM and covers wider age range and assessed more complex and more advanced levels of ToM in comparison with earlier version of the test. The test has three subscales: 1-Precursors ToM; i.e. "first level of TOM" that tests recognition of pretence or emotions. Contains 20 items . 2-First manifestations of a real ToM; i.e. Second level of ToM that tests first-order belief and understanding of false belief . Contains 13 items . 3-More advanced aspects of ToM; i.e. third level of ToM that tests second-order belief and understanding of humor. Contains 5 items . This individual test runs along with images and stories, followed by some post-hoc questions which correct answers scored "1" and incorrect ones scored "0" as well. In whole test, the examinee may get a mark in the range of "0" to "38". Higher marks indicate higher level of ToM. The test was assessed for its validity and reliability in Iran by Ghamarani et al. [21]. To assess the validity of the test, content validity, correlation of subscale with whole scale and concurrent validity was administered. To estimate concurrent validity tests, correlation with dull-house task was measured (0.89). Validity of the test with whole test was significant in all types ranged 0.82 to 0.96. The reliability varied in the range of 0.70 to 0.94. Using chronbach alpha, inside stability of test was calculated as respectively: 0.86, 0.72, 0.82, and 0.81, but raters' reliability coefficient was 0.98. Interview with mothers: the number of siblings and sequence of birth were checked by a short interview with mothers and ID cards were seen for confirmation of date of birth.

**Wechsler intelligence Scale for Children Revised:** WISC-R includes subscales and is performed individually and gives three IQ marks: 1) verbal quotient, 2) non-verbal quotient, and 3) total quotient. Persian version is designed for normal children ages from 6 to 13 years. Validity coefficient was calculated by split-half reliability correlation coefficient for verbal and nonverbal subscales (except for two subscale: 1- digit memory which is comprised of 2 different parts and 2- encoding that is a test for measuring the speed) utilizing a correct Spearman-Brown correlational coefficient ranging from 0.42 to 0.98 and medium coefficient was 0.96. The reliability coefficient for the test was assessed by a test and retest method ranging from 0.44 to 0.94 (encoding and calculating was less estimated) [22]. For reliability determination, Shahim [22] compared the scale with Wechsler's pre-school and school scale and then reported the correlational coefficient in verbal, nonverbal, and

whole IQ as: 0.84, 0.74, and 0.85. The present study progressed in the way that, firstly, researchers provided permissions and coordination with the center's authority. Parent consent was taken by calling the mothers to come to school. Excluding those who were not qualified, rest of the students was individually tested by WISC-R and ToM tests. The sample became randomly divided into two groups. In group 1, intelligence test was run and then, after a week, ToM tests were done, but in the other group, conversely, first ToM tests and a week later intelligence test were taken. Comparing two groups assured us that, it was discovered that neither of the tests influenced on each other. Each participant was tested in a 25-minute session in which first, UCT task was administered and then 38-item ToM test was conducted based on the guideline. Finally, WISC-R was run during one hour and 20 min. weekly educational sessions were being held for mothers to collect personal information of children, along with testing children. Gathered data was analyzed by SPSS-18. One-way-ANOVA, Scheffe, Pearson correlation coefficient and  $\chi^2$  were conducted.

## Results

It is necessary to mention that, only 2 out of all 59 participants were able to give correct answers to questions of third level ToM, so, development of third level ToM and its relevance to verbal and non-verbal abilities was not investigated. Around 50% of fathers and 44% of mothers had never gone to school and 35% of mothers had only experience primary school. There were no monthly income higher than 300,000 Tomans (less than 300 US\$ per month), so comparing average family income, all of the children were born in relatively poor families. All children, but 7, lived with both of their

parents. The analyses of ToM development of IDs with ANOVA and chi-square revealed that there were significant difference between age groups and both first and second level of ToM (Table 1). To find out between-groups differences, Post hoc scheffe was utilized and the result showed that in terms of first and second level ToM, 8-9 years olds had significant difference with both 11-12 and 12-13 years old children ( $p=0.01$ ). In other groups, differences were not significant. ToM development was investigated by UCT as well. The results of chi-square test showed that ToM developed ascending (Table 1). To examine relationship between ToM and verbal and non-verbal abilities, Pearson correlation coefficient was used. The result showed that first and second level of ToM were significantly correlated with verbal and non-verbal abilities ( $p<0.05$ ), though this correlation was not evidenced for all subscales: first level of ToM did not indicate significant correlations with verbal sub-tests (i.e., vocabulary and similarities) and non-verbal sub-tests (i.e., blocks design and object assembly). In UCT, there were significant differences in terms of verbal and non-verbal abilities between those students who acquired ToM and those who did not ( $p<0.05$ ). Although this kind of differences could not be found in verbal sub-tests (including vocabularies and similarities), neither in non-verbal sub-test (including picture arrangement, block design and object Assembly). Altogether, the students who acquired ToM had more verbal and non-verbal abilities than those who did not (Table 2). To examine links of ToM with the number of siblings, Pearson correlation coefficient and chi-square were applied and disclosed that (table 3) first and second level of ToM were not significantly correlated to the number of siblings. The same findings repeated when UCT was completed (Tables 3).

**Table 1.** Comparison of ToM1, ToM2, and UCT among six age group

Age (N)	ToM <sub>1</sub>		ToM <sub>2</sub>		Unexpected content $\chi^2$ (df)
	Mean $\pm$ SD	F (df)	Mean $\pm$ SD	F (df)	
8-9 (9)	11.44 $\pm$ 4.21		4.22 $\pm$ 3.38		
9-10 (10)	13.70 $\pm$ 3.33		5.60 $\pm$ 4.95		
10-11 (6)	14.83 $\pm$ 4.95	3.58 (5)**	8.17 $\pm$ 3.86	4.07 (5) **	11.85 (5) *
11-12 (15)	16.60 $\pm$ 3.22		8.53 $\pm$ 2.53		
12-13 (12)	17.00 $\pm$ 2.48		8.50 $\pm$ 2.54		
13-14 (7)	15.14 $\pm$ 3.23		6.14 $\pm$ 1.95		

\* $p<0.05$  & \*\* $p<0.01$

**Table 2.** Correlation of ToM1 and ToM2 with verbal and non-verbal abilities/ and comparison of verbal and non-verbal abilities in passer and failed participants of UCT

Variables	Intelligence	ToM <sub>1</sub>	ToM <sub>2</sub>	Unexpected content		<i>t</i> (df=57)
	Mean $\pm$ SD	r	r	Failed (N=17) Mean $\pm$ SD	Passer (N=42) Mean $\pm$ SD	
Verbal intelligence	56.03 $\pm$ 10.13	0.55**	0.68**	50.65 $\pm$ 8.02	58.21 $\pm$ 10.58	-2.65**
Information	2.73 $\pm$ 2.34	0.48**	0.48**	1.71 $\pm$ 1.21	3.14 $\pm$ 2.56	-2.20*
Similarity	2.17 $\pm$ 1.4	0.22	0.39**	1.53 $\pm$ 1.28	2.43 $\pm$ 2.37	-1.47
Calculation	3.46 $\pm$ 2.8	0.54**	0.62**	2.12 $\pm$ 1.72	4.00 $\pm$ 2.27	-3.06**
Vocabulary	2.00 $\pm$ 1.47	0.20	.32**	1.65 $\pm$ 1.22	2.14 $\pm$ 1.55	-1.17
Comprehension	5.86 $\pm$ 2.94	0.56**	0.64**	4.53 $\pm$ 3.64	6.40 $\pm$ 2.46	-2.29*
Nonverbal intelligence	54.10 $\pm$ 30	0.33*	0.51**	49.71 $\pm$ 7.54	55.88 $\pm$ 10.80	-2.14*
Picture Completion	3.34 $\pm$ 2.30	0.29*	0.45**	2.06 $\pm$ 1.56	3.86 $\pm$ 2.37	-2.87**
Picture Arrangement	2.07 $\pm$ 2.25	0.30*	0.39**	1.35 $\pm$ 1.45	2.36 $\pm$ 2.45	-1.57
Block Design	2.61 $\pm$ 2.11	0.18	0.31**	2.29 $\pm$ 2.31	2.74 $\pm$ 2.04	-72
Object Assembly	2.92 $\pm$ 2.61	0.22	0.42**	2.06 $\pm$ 2.04	3.26 $\pm$ 2.75	-1.62
Coding	2.14 $\pm$ 1.52	0.37**	0.42**	1.65 $\pm$ 1.41	2.33 $\pm$ 1.54	-1.58*

**Table 3.** correlation of ToM1 and ToM2 to and UCT with number of sibling

Variables	ToM <sub>1</sub>	ToM <sub>2</sub>	Unexpected content
	r (N)	r (N)	$\chi^2$ (df)
Sibling	0.05 (57)	0.08 (57)	11.85 (2)
Older sibling	-0.03 (46)	-0.01 (46)	1.61 (1)
Younger sibling	0.22 (45)	0.25 (45)	1.27 (1)
Brothers	0.09 (57)	0.13 (57)	2.51 (1)
Older brother	0.06 (47)	0.06 (47)	1.7 (1)
Younger brother	0.02 (47)	0.08 (47)	4.10 (1)
Sisters	-0.02 (57)	-0.01 (57)	1.64 (1)
Older sister	0.20 (47)	0.25 (47)	0.01 (1)
Younger sister	-0.09 (46)	-0.14 (46)	0.789 (1)

## Discussion

In response to the first goal, results showed that ToM development depending on type of the instrument used might vary. When a developmental approach-based test is applied (38-item test), a certain pattern will be seen; so that: students in the age of 11 to 13 years old typically reach higher marks than others. The marks of students aged 8 to 11 and 13 to 14 are not significantly different. Data suggest that 1st and 2nd level ToM have ascending direction up to age 12 and then decreases or stops. Like in normal persons, mental abilities (including ToM) in ID persons may decline with age. Rushton and Ankney [23] found that mental abilities increase in childhood but by getting adulthood, esp. by 45, the abilities will reduce. It may happen even sooner in ID people.

This finding disagreed with what Ghamarani and Alborzi [21] reported in a research using the same instrument in ID student in the age between 7 and 9. They reported that 8 to 9 years old students reach higher marks in compare with students in the age of 7 to 8. ToM direction is upward, even in case none of them reach third level of ToM. The difference in findings may root in ethnicity. Inconsistency of results from UCT and 38-Item test could stem from the theoretical bases. UCT is based on a traditional view in which correct answer indicates ToM attainment whereas 38-item test is designed on a developmental multi-dimensional view and assesses wider age range and also more complicated levels of ToM [21]. The relation of ToM with number of siblings was also investigated. As is shown in table 3, ToM (1st, 2nd, and UCT) was not significantly associated with number of sibling.

Mc Alister and Peterson [6, 7] in a long term study on 63 normal pre-school children found that number of sibling in close age could predict ToM. Ruffman et al. [3] with a counterfactual study in England and Japan discovered an increasing linear association between ToM and number of older brothers and sisters. The finding of present study is inconsistent with theories of socio-cultural approach which focus on child experience of communication with people around him/her. Socio-cultural approach assume that children who usually talk with members of their family, because of more chances to learn about how other people think, show better performance in those tasks which require mind perception [5]. Absence of significant linkage between ToM and number of sibling could be justified by several reasons:

first, brothers and sisters may not spend enough time to talk with ID child about mental states or they may be reluctant to talk about it at all. If so, the child will lack verbal communication. Second, the child may not have sufficient preparedness or even capacity to perceive process or to learn mental states through communication. In this presumption, child has enough communication but due to cognitive limitations they are unable to benefit from communication with sibling. To find out which reason or a mix of reasons prevent ID children from suitable learning future research might be needed. The results have shown that ToM development of IDs is positively correlated to verbal and non-verbal abilities. It disapproves Happe [13] and Adab [12] but confirms most other previous researchers [7, 15, 16].

The relationship of ToM with verbal ability might be for the role of language. Researchers have discovered that linguistic abilities are strongly related with children's TOM. This relationship was found both in normal [24] and ID children [2, 15, 16]. Studies have shown that working memory [8] and executive function [6, 9-11] are associated with children's TOM. So, these factors may underlie the links of ToM with non-verbal abilities. Results of current study, on the other hand, verified modular approach expectations.

In this approach, development of general abilities is assumed as a source of responding to ToM tasks [25]. Modular theorists believe that a part of brain is specialized in ToM processing [26]. Let's remember that most of the parents were completely illiterate or had only basic school education. Therefore, they would fail to help students in academic matters. It seems that type of task we used to measure ToM development is important so that using different tests may change the result in intellectual disabled students. Altogether, the things "theory theory" and "modular" approaches state might be acceptable.

Those theories which are based on sociocultural approaches expressing experiment of communication underlies mind understanding development must be more examined. The result of this study revealed that ID students do not reach third level ToM. So, trains in this scope should be designed.

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## Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

## Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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