

Aptitudes, Capabilities, and Interests of Children with Autism Spectrum Disorder

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ABSTRACT

Some individuals with autism spectrum disorder (ASD), may display some areas of talent that are in contrast with their overall low level of general functioning. The aim of this study was to investigate the frequency of special abilities (aptitudes, capabilities, and interests) in a sample population of individuals with ASD. One in ten persons with ASD has special abilities in varying degrees. Researchers used to consider special abilities unimportant. However, this is an area of research for scientists and educators who are making attempts to understand the complexities and intricacies of the human mind. There have been reports of individuals who have intellectual disabilities and challenges, yet possess extraordinary abilities in reading, arithmetic, calendar calculations, art, or music. The study investigates the percentage and frequency of special abilities as reported by parents and teachers in a sample population of individuals with ASD in Singapore using a quantitative methodology. Parents and teachers were given questionnaires to ascertain this occurrence.

1. Introduction

What do we know about ASD and special abilities? The definition of special abilities that pertains to this paper is about a skill that is exceptional both in terms of population norms and above the individual's overall level of ability. It is important to understand the relationship between ASD and special abilities as the two are closely connected (Boso et al., 2010; Clark, 2001). A 'special ability' according to Soulieres et al, (2010), consists of a peak in cognitive abilities that contrast differently from the measured overall intelligence of that person, usually with a diagnosis of ASD. Today, parents and teachers of individuals with ASD are focused on the individual's deficits rather than on his or her strengths (Clark, 2016).

This study investigates the percentage and frequency of special abilities in a sample population of individuals with ASD in Singapore. Has the number or percentage of special abilities among persons with ASD remained the same? Is the 10% prevalence reported by Rimland (1978) an accurate estimation based on today's population of individuals with ASD?

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Due to the small sample size of the study, the result may not be representative of the overall ASD population either in Singapore or worldwide.

Parents are usually the first people to notice a special talent or skill in their child with ASD. Since many parents spend a considerable amount of time with their child, they will be best placed to determine if their child has any special abilities (Russel, Rodgers, Ukoumunne, & Ford, 2014; Sheldrick, Sheldrick, Maye, & Carter, 2017; Ward, Sullivan, & Gilmore, 2016). Research has indicated that parents strongly believe that they need to nurture the education and developmental growth of their child with ASD (Turygin, Matson, Williams, & Belva, 2015; Zuckerman, Lindly, & Sinche, 2015).

1.1. Incidence of Individuals with ASD Who Have Special Abilities

Rimland (1978) looked at the incidence of special abilities in 5,400 children with ASD whose parents had indicated that their child had a special skill or talent. Rimland collated his data from a questionnaire that the parents had completed. According to Rimland, 531 children with ASD, or approximately 10% were reported to have special skills or talents. Other researchers have reported that at least ten percent of the ASD population showed some form of special ability (Bennett & Heaton, 2017; Bouvet et al., 2014; Meilleur et al., 2015; Rieznik & Sigman, 2017).

1.1.1. Purpose (Rationale) of Study

The rationale of this study was to investigate the frequency of special abilities, aptitudes, capabilities, and interests) as reported by parents and teachers.

2. Method

This study involved the implementation of a questionnaire with both parents and teachers of children with ASD in special schools to facilitate the investigation into the frequency of special abilities in a sample population of individuals with ASD. Rimland (1978) reported that ten percent of the population of individuals with ASD has special abilities. This study attempted to answer the following research questions in this study. They were:

- 1a. What is the proportion of individuals with ASD who have special abilities as reported by parents?
- 1b. What is the proportion of individuals with ASD who have special abilities as reported by teachers?

2.1. Research Design

This study revisited the earlier findings by Rimland (1978) that the prevalence of special abilities in the population of individuals with ASD is approximately 10 percent. Statistical Package for the Social Science (SPSS) program was used to compute the frequency of respondents with ASD population who had special abilities. This study used a questionnaire to obtain the necessary data.

2.2. Sampling

Sampling for this research study was taken from amongst the special schools that were ASD-specific in Singapore and also included selected individuals with ASD from mainstream schools. All the ASD-specific special schools in Singapore were approached. Other special

schools, that are not ASD specific, were not approached because they have very few students who are on the ASD spectrum.

Amongst the special schools that were approached, some did not respond to the invitation to participate in this study. Eight special schools were eventually approached. In order to increase the sample size, friends whose children have ASD were also approached to participate in this study. These children attended various types of educational organisations, including special, private, and mainstream institutions.

Mainstream schools were not approached for the sampling because the number of children with ASD in mainstream schools is extremely small in Singapore. According to Lim (2016), there are 18,000 students (about four percent of the total student population) with mild special educational needs in mainstream schools, including ASD. These statistics were provided by a spokesperson from MOE (Ministry of Education). According to the Education Statistics Digest (2016), there are a total of 454,697 students in Singapore across 366 schools. Based on these statistics, there would only be approximately 50 students with special education needs in each school, which makes it a small sample. It is also extremely challenging to get questionnaires filled up in such schools without the permission of the principal, which is rarely granted. The special schools were selected based on the criteria that they had a large population of ASD students or that they catered only to ASD students.

The dissemination of the questionnaires to the parents and return of the completed forms proceeded in the following manner: 1) questionnaires were personally delivered to the school, 2) a school administrator would then deliver the questionnaires to the classroom teachers, 3) the classroom teachers would place the questionnaires into the students' school bags, 4) upon completion of the questionnaires, parents would mail back the questionnaire in a stamped return envelope.

The response rate of the questionnaire was low. This might be due to several possible factors including the lack of interest in the subject matter among parents, length of the questionnaire, and/or questionnaire fatigue among parents due to participation in other research studies. Procedurally, questionnaires from teachers were mailed back to the researcher. In retrospect, a more productive method and higher response rate may have been achieved had the completion of questionnaires been scheduled at specific timing and location, and the collection was done immediately after the questionnaire session.

To increase the number of responses, the author(s) actively contacted family friends and acquaintances who sat on the different school boards to get approval for the study to be conducted in the school. The initial request to schools drew close to nil responses whereby almost all of them did not reply or respond to the researcher's request via email and/or telephone calls. To increase the response rate from teachers, the same set of questionnaires was resent to those who had failed to respond.

In the information sheet given to participants, it was stated that the confidentiality of all research participants and collected data would be upheld. All personal information was coded at the earliest possible opportunity and subsequent references only used the coded aliases. All the participants' names were kept confidential and their identity was not used in the reporting of the research data nor any publications of any sort, be it electronic or print media. All records containing personal information will remain confidential and no information which may lead to the identification of any individual will be released.

2.3. Participants

The participants in this study were parents of individuals with ASD. 1000 questionnaires were distributed via schools or directly to parents of individuals with ASD. A total of 135 responses (a response rate of 13.5%) were received. All the participants in this study had children who had received a formal diagnosis of ASD from a paediatrician, psychiatrist, or psychologist.

Furthermore, the teachers of the 135 children who responded were approached to complete the same questionnaire regarding special abilities. Out of 135 questionnaires, 40 questionnaires were completed and returned. These teachers had spent at least one term of ten weeks teaching the individual with ASD that the questionnaire was targeted at.

Materials

The main materials used for this phase of the study are the Autism Treatment Evaluation and Checklist (ATEC) and the questionnaire, which will be described in the following paragraphs.

2.4. ASD Symptomology

The Autism Treatment Evaluation Checklist (ATEC) (Rimland & Edelson, 1999) is a 77-item checklist measuring communication and behavioural challenges amongst individuals with ASD. This checklist was given to the parents to complete. The checklist was designed to assist parents, teachers, physicians, and researchers to evaluate virtually any treatment for ASD. It takes approximately ten minutes to complete. ATEC is a convenient procedure that will calculate four subscale scores and a total score. It comprises speech/language/communication, sociability, sensory/cognitive awareness, and health/physical/behavioural subscales. The scores are weighted according to the responses and the corresponding subscales. The higher the subscale and total scores, the more impaired the subject. The ATEC is sensitive to changes in an individuals' progress due to the result of a treatment (Jarusiewicz, 2002, Lonsdale, Shamberger, & Audhya, 2002).

ATEC is a diagnostic assessment tool designed to evaluate the effectiveness of autism treatments and may be used as a screening tool for children. ATEC was selected as a research tool in this study to determine whether an individual has ASD. Over the past years, researchers have reported and presented numerous studies to assess the various biomedical and psycho-educational interventions intended to benefit individuals with ASD. However, many of these research studies, have produced inconclusive outcomes. This may be due to the lack of tests or scales that are designed to evaluate if the treatment is effective. Thus, in the past, researchers have resorted to using scales such as the Childhood Autism Rating Scale (CARS), the Gilliam Autism Rating Scale (GARS), or the Autism Behavior Checklist (ABC), to diagnose autism in individuals. There was no checklist to measure the effectiveness of treatment with regards to ASD. The ATEC checklist was used in various studies related to ASD (Geir, Kern, & Geir, 2013; Memari, Shayestehfar, Mirfazeli, Rashidi, Ghanouni, & Hafizi, 2013; Weiner & Greene, 2014).

2.5. Questionnaire

A questionnaire for parents and teachers was specially developed for this study. This questionnaire was adapted from Clarke (2001). In this questionnaire, parents were asked to rate their child's special abilities according to the prevalence of their child's special abilities and the usefulness of the skill(s). The questionnaire required approximately ten minutes to

complete. These questions were targeted at screening for individuals with ASD that may have special abilities. As mentioned, there were two versions of this questionnaire: the parent's survey and the teacher's survey. In addition, the parent survey was translated into Chinese and Malay languages.

The first part of the questionnaire listed the different types of special abilities such as memory, hyperlexia, mathematical calculations, art, music, pitch, spatial, calendar calculations, sensory, and athletics, and respondents are invited to rate if the skills were present in the child and if so, to rate the degree of such skills. For example, for each particular skill, a parent had to indicate: no special skill, only special in relation to his/her overall ability, special in comparison to other individuals with similar age and would be considered exceptional in the normal population. The parents also had to rate the usefulness of the skill based on the following options: of very little use (e.g. memorizing of names of soccer players in a team), of some use (e.g. advanced reading ability), or of a great deal of use (e.g. playing of a musical instrument).

2.6. Procedures

Approval to conduct this study was obtained from the NTU (Nanyang Technological Institution) Institutional Review Board before the study commenced. First, the author(s) contacted the various government and private special schools as well as private organisations that catered to individuals with ASD to seek permission to distribute the questionnaires in the respective schools and organisations. Once the schools and organisations granted permission to this study, the author met up with the principals and/or certain school personnel to explain the study in greater detail and what was needed for the school to follow up on. An email was also sent to the school principal detailing the steps that were to be taken. With the principal's approval, the author(s) then sent sealed envelopes that included the following items: the questionnaire, an information sheet with a brief explanation of the study, the ATEC, and the questionnaire and the consent form for the parents to complete and sign. There was a stamped return envelope for the parents to mail the questionnaire.

The questionnaires were personally delivered to the various schools and the respective school personnel distributed the sealed envelopes to the parents. Some questionnaires were personally handed to friends of the author(s) who had a child or children with ASD.

A separate set of questionnaires was given to the teachers of students whose parents had completed and returned the questionnaire. As the identities of the teachers were indicated in the parent questionnaires, the author(s) was able to contact the teachers for them to fill up the questionnaires. This was a form of triangulation regarding the reporting of the parents on their child's special abilities and the perception regarding these skills.

2.7. Data Analysis

A structured methodology was taken to analyse the responses to the questionnaires returned by the parents and teachers. When the questionnaires were returned, the responses were transferred into an Excel spreadsheet. On completion of the data collection and input into a table format, the data were checked for accuracy before the analysis was conducted. Statistical analysis was then performed using SPSS software. Information that was sought from the analysis included finding the percentage of individuals with ASD who have special abilities based on their aptitudes, capabilities, and interests.

3. Reliability and Validity of Research Study

To ensure the reliability and validity of the study, the appropriate research tools and analytical approaches were selected.

The ATEC checklist was selected for the quantitative portion of this research as there were numerous affirmations regarding the reliability and validity of this tool. Multiple published studies have used the ATEC report as the basis of their quantitative analysis. The reliability of the ATEC report has been assessed by examining the internal consistency of the ATEC by conducting a split-half reliability test on over 1,300 completed ATECs. The internal consistency reliability was determined to be 0.94 for the total score (Geier, Kern & Geier, 2013). As for the validity of the report, there were at least three published studies, which have shown the ATEC to be sensitive to changes as a result of a treatment:

- Efficacy of neurofeedback for children in the autism spectrum (Jarusiewicz, 2002)
- Treatment of autism spectrum children with thiamine tetrahydrofurfuryl disulphide (Lonsdale, Shamberger, & Audhya, 2002)
- Retrieved from www.gfcfdiet.com/dietsurveysept2.htm (Klaveness & Bigam, 2002)

4. Results

The following are the findings from data collected from the parent and teacher questionnaires. The research questions were:

(1a) What is the proportion of individuals with ASD who show special abilities as reported by parents?

(1b) What is the proportion of individuals with ASD who show special abilities as reported by teachers?

The questions in the questionnaire were adapted by Clark (2001) and were distributed to 1000 parents whose child/children were diagnosed with ASD and attend special schools, mainstream schools, or private special education centres. Furthermore, the Autism Treatment Evaluation Checklist (ATEC) (Rimland & Edelson, 1999) was used as a checklist to describe the symptoms of ASD among this group of children.

The data was obtained from self-administered questionnaires completed by 135 parents (all of whom have at least one child with ASD) and 40 teachers from various special and mainstream schools and private special education centres. The teachers of the children whose parents had completed the questionnaires were also invited to complete one set of questionnaires. 40 teachers responded for their respective students. All the parents who had completed the questionnaire were given an ATEC form to complete.

4.1. Number of Respondents

A total of 1000 questionnaires were distributed via the schools to parents who have children with ASD. Out of the 1000 questionnaires, 135 questionnaires were completed by parents and returned to the author(s), thus achieving a 13.5% return rate.

A further 109 questionnaires were then sent out to the teachers of the students whose parents had completed and returned the questionnaires. Teacher questionnaires were used as a way to triangulate the information collected from the parent questionnaires. A total of 40 questionnaires were completed by teachers and returned to the author(s).

4.2. The Proportion of Special Abilities Reported by Parents of Children with ASD

The table lists the breakdown of special abilities (in percentages) as identified and reported in the questionnaire by the parents. The data showed that calendar skills had the highest number of children who would be considered as having no special abilities. Memory skills had the highest number of children who have ‘skills only special in relation to his/her overall ability. Memory skills also had the highest number of children who have skills ‘special to other individuals of a similar age’. Memory and sensory skills were mentioned most frequently for children who ‘would be considered exceptional in the normal population’. (Kindly see Table Table 1).

Table 1.
Distribution of Special Abilities Amongst the 135 Children

	NSK	SIR	SIC	ENP
1. Memory	47.4%	23.7%	20.0%	8.9%
2. Hyperlexia	74.8%	14.8%	7.4%	3.0%
3. Math	77.8%	14.8%	5.9%	1.5%
4. Art	80.7%	9.6%	4.4%	5.2%
5. Music	71.9%	14.1%	8.9%	5.2%
6. Pitch	73.3%	13.3%	8.9%	4.4%
7. Spatial	59.3%	20.7%	13.3%	6.7%
8. Calendar	87.4%	6.7%	2.2%	3.7%
9. Sensory	57.0%	22.2%	11.9%	8.9%
10. Athletic	71.1%	15.6%	10.4%	3.0%
11. Other	77.8%	10.4%	8.1%	3.7%
12. Any	22.2%	61.5%	46.7%	23.7%

Note. NSK = No Special ability; SIR = Only special in relation to his/her overall ability; SIC = Special to other individuals of similar age; ENP = Would be considered exceptional in the normal population.

Based on the data from this study, more than 10% of individuals with ASD have special abilities. In this study, the two criteria used to determine whether a child has special abilities include:

- i. Special in comparison to other individuals with similar age
- ii. Would be considered exceptional in the normal population

From the parents’ responses, 75 of the 135 children were reported as having special abilities based on the above two criteria, generating a frequency score of 55.6%. Using the strictest criteria of ‘would be considered exceptional in the normal population’, 32 children would qualify as having special abilities. This would give a frequency score of 23.7%, which is higher than the 10% frequency as reported by Rimland (1978).

Therefore, the most common forms of special ability based on the criteria of ‘Special in comparison to other individuals with similar age’ and ‘Would be considered exceptional in the normal population’, were memory, spatial and sensory followed by art and music (Kindly see table Table 2)).

Table 2.
Distribution of Reported Special Abilities amongst the 135 Children

Number of Special Abilities	Any Special Ability (%)	SIR (%)	SIC (%)	ENP (%)
0	22%	0%	0%	0%
1	10%	6%	4%	0%
2	16%	12%	8%	1%
3	12%	11%	6%	1%
4 or more	40%	27%	13%	21%

Note. SIR = Only special in relation to his/her overall ability; SIC = Special to other individuals of similar age; ENP = Would be considered exceptional in the normal population.

Table 2 shows that 22% of the children are reported to not have any special abilities according to their parents. 10% of the children have one special ability, 16% have two special abilities, 12% have three special abilities, and 40% have four or more special abilities.

4.3. Triangulation of the Teachers and Parents Reported Data amongst the 40 Cases Regarding Incidences of Special Abilities

The following section reports the cross-tabulation findings regarding ‘any skill’ obtained from the triangulation of the parents’ and teachers’ responses to the questionnaires. There were altogether 40 instances of both parents and teachers completing a questionnaire about a particular child. The cross-tabulation findings between parents and teachers for each of the special abilities are included in Table 3.

4.3.1. Cross-Tabulation Regarding any Special Ability between Teachers and Parents

For four individuals with ASD in the study, both parents and teachers did not report the presence of any special abilities. For four other individuals with ASD where the parent did not report the presence of any special ability, the teachers disagreed and reported the presence of special abilities. For six individuals with ASD in the study, both parents and teachers reported that the child’s special abilities were special in relation to his or her overall ability. For four other individuals with ASD where the parent reported that the child’s special abilities were special in relation to his or her overall ability, the teachers disagreed with the assessment. For four individuals with ASD in the study, both parents and teachers reported that the child’s special abilities were special in comparison to other individuals of similar age. For eight other individuals with ASD where the parent reported that the child’s special abilities were special in comparison to other individuals of similar age, the teachers disagreed with the assessment. For nine individuals with ASD where the parent reported that the child’s special abilities were exceptional in the normal population, none of the teachers agreed with the assessment.

Table 3.
Cross tabulation between Parents and Teacher (Any Special Abilities)

Parent	Special Ability (Teachers)				Total
	NSK	SIR	SIC	ENP	
NSK	10.0%	5.0%	5.0%	0%	20.0%
SIR	7.5%	15.0%	5.0%	0%	27.5%
SIC	10.0%	10.0%	10.0%	0%	30.0%
ENP	12.5%	5.0%	5.0%	0%	22.5%
Total	40.0%	35.0%	25.0%	0%	100.0%

Note. NSK = No Special Ability; SIR = Only special in relation to his/her overall ability; SIC = Special to other individuals of similar age; ENP = Would be considered exceptional in the normal population.

Therefore, it was found that there is not much significance in the dependency between parents' and teachers' perceptions of each of the nine special abilities. The level of significance is $\alpha=0.05$, which means any sig (p-value) greater than 0.05 is not statistically significant. However, it was noted that there is a significant difference between the perception of parents and the perception of teachers in terms of children's special ability in memory skills.

4. Conclusion

This research study comprised the quantitative analysis of data collected through the utilisation of a questionnaire, which was responded to by 135 parents, and 40 teachers.

Among the 135 parents, more than half, 105 parents (77.8%) reported that their child exhibits some form of special abilities. When parents were asked to evaluate their child's special abilities based on the criteria that the skills had to be 'special at least in comparison to other individuals of similar age', 55.6% of the 135 children were viewed as possessing special abilities. The proportion of those who possess special abilities varied largely from the 25% identified and reported by the teachers. When adopting the stricter criteria of special abilities being 'considered exceptional in the normal population', 32 children (23.7%) of the participating group qualify as having special abilities.

Parents' perceptions of special abilities have an impact on the parents' overall influence and support for shaping and nurturing their child's development of special abilities (Turygin et al., 2015; Zuckerman et al., 2015). Since parental influence and support may not be the exclusive factors that would explain why some individuals with ASD display special abilities, it is important for this study to consider the perception of teachers when considering a child's special abilities. The triangulation of information collected also served to prove the validity and soundness of the collected data.

There are several notable implications of this study. The first is that the quantitative findings indicate that there may be a larger percentage of individuals with ASD who possess special abilities than established in prior literature.

5. Limitations

The following is a list of limitations to this study. First, there were 135 subjects in the quantitative study. This number is unlikely to be representative of Singapore's population of individuals with ASD. According to Channel News Asia (2019), there are about 25,600 students with special needs that are currently in mainstream schools in Singapore. Many of the individuals in this study were from special schools, which may have biased the findings of the study given that many special schools in Singapore generally accept students with a performance IQ of 80 and below. Secondly, not all the special schools participated in this study.

6. Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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