International Journal of Innovation Scientific Research and Review
Vol. 05, Issue, 01, pp.3870-3874, January 2023
Available online at http://www.journalijisr.com
SJIF Impact Factor 4.95

ISSN: 2582-6131

Research Article

A LITERATURE OVERVIEW ON THE RELATIONSHIP BETWEEN AUTISM SPECTRUM DISORDER AND SAVANT SKILLS

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Received 26th November 2022; Accepted 27th December 2022; Published online 30th January 2023

ABSTRACT

Individuals with autism spectrum disorder (ASD) feature extensively in discussions on savant syndrome and seem to be the most prevalent group among the savant population. It is important to understand the relationship between ASD and savant syndrome as the two are closely connected. A 'special ability' according to some researchers, consists of a peak in cognitive abilities that contrast differently from the measured overall intelligence of that person, usually with a diagnosis of ASD. Extraordinary abilities or savant skills have been reported in individuals with ASD in various domains such as fast mathematical calculations. There are more reported cases of savant skills amongst individuals with ASD as compared to other developmental disabilities. Studies frequently link ASD to savant syndrome. Much of the collected data and published studies demonstrate a strong link between ASD and the emergence of special skills.

Keywords: savant skills, autism spectrum disorder, relationship.

INTRODUCTION

ASD and Savant Skills

Individuals with autism spectrum disorder (ASD) and the link to savant syndrome are often researched and written about quite extensively in research papers and appear to be quite widespread amongst the savant population (Bennett & Heaton, 2017; Clark, 2001; Skuse, 2011). The term savant is derived from the French word meaning to know and was first used by J. Langdon Down in 1887 to describe individuals with intellectual disabilities who possessed an exceptional ability (Crane *et al.,* 2011; Howlin *et al.,* 2009; Roger, 2011; Treffert & Wallace, 2006; Treffert, 2014). Down coined the term idiot savant to refer to individuals with severe intellectual disabilities who possessed extraordinary skills (Treffert, 1998). However, the term idiot savant is no longer used as it is considered offensive. The term idiot savant has been replaced with the term autistic savant or individuals with ASD who display savant skills. Goodman coined autistic savant in 1972 (Clark, 2001). The term autistic savant is used to refer to individuals with ASD with differing degrees of intelligence who display exceptional (gifted) abilities and experience subtest scores on standardized intelligence tests that are within the gifted range (Donnelly & Reuben, 1994).

Down characterised savants with autism as aloof persons who speak in the third person, have rhythmical movements and appear less responsive towards friends. Today, this condition is known as ASD (Darius, 2007; Treffert, 2014). In 1973, the American Association of Mental Retardation (AAMR) described a savant as an individual with low intelligence who possesses a high ability in certain tasks such as mental calculations (Grossman, 1983). Therefore, a savant is classified as an individual who demonstrates exceptional skills despite having an overall low level of general functioning (Finocchiaro, 2015; Treffert, 2009; Treffert, 2014; Young, 2001).

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NARROW NATURE OF TALENTS

Individuals with ASD who have savant skills are most often identified by the very narrow nature of their talents (Hughes *et al.,* 2017; Treffert, 2014). BeateHermelin (2001), a professor at Goldsmith College in London, has been studying splinter skills among such individuals. She was one of the first researchers to study groups of individuals with ASD who possessed different skill domains, while earlier studies focused on one individual or a singular skill (Hermelin, 2001). It was noted that some individuals with low intelligence display incredible ability in the memory domain, which includes musical ability, mathematical calculations, calendar calculations, art and mechanical skills (Bennett & Heaton, 2017; Meilleur *et al.,* 2015; Treffert, 2009). Other talents, including prodigious language (poly-glot) facility, and unusual sensory discrimination in the areas of touch, smell and vision, have been reported but to a much lesser degree. Other skills include neurophysiology, statistics and navigation (Treffert, 2009). In their domains of expertise, these individuals resemble child prodigies, exhibiting a voracious appetite to learn and refine their skills in their areas of interest and talent (Winner, 2006). The various skills exhibited by individuals with ASD who display savant skills fall into a narrow range. However, considering the many skills that human beings possess, the degree of abilities involved in executing these skills is extensive and can range from limited (restrictive) to prodigious (Bennett & Heaton, 2017; Meilleur *et al.,* 2015; Treffert, 2014). The savant skills that individuals with ASD display often occur in one of the following domains: calendar calculation; music – almost exclusively to the piano; rapid calculation and solving of mathematical problems; art – painting, drawing, or sculpting; prodigious memory (mnemonism) or very unusual sensory discrimination – smell, touch or extrasensory perception (Hollander & Uzunova, 2017; Hughes *et al.,* 2017; Prochnow, 2014; Puente *et al.,* 2016).

INDIVIDUALS WITH ASD WHO DISPLAY SAVANT SKILLS

Individuals with ASD who display savant skills have much in common with cases of unevenly gifted children. Similar to highly gifted children

who possess strong mathematical or artistic abilities, individuals with ASD who display savant skills tend to show a highly developed visual-spatial ability in conjunction with severe or profound language challenges (Happe & Frith, 2009; Hughes, 2012; Jaworski & Eigsti, 2017; Jeon, 2016; Treffert, 2014). Individuals with ASD who display savant skills can either have a singular skill or multiple skills. Individuals with ASD who display savant skills may have specialized skills or talents that are concrete, non-symbolic, right hemisphere skills and highly reliant on memory (Bennett & Heaton, 2017; Shuqin, 2013; Sinha, 2014). Although there are professionals and caregivers in the field of ASD who do not agree with some of Treffert's terminology, such as the classification of early infantile autism as a mental illness, his definition of the savant syndrome incorporating levels of savant ability is widely accepted. There are cases of spatial or mathematical talents that coexist with verbal deficits that are found in individuals with ASD who display savant skills. The majority of individuals with ASD who display savant skills have IQs of below 70. Some individuals with ASD who display savant skills will exhibit one skill at a normal level whilst others will display one or multiple skills that may be comparable to a prodigious level (Finocchiaro, 2015; Treffert, 2016).

SOME FACTS ABOUT SAVANT SYNDROME

The next few sections will describe some of the more common facts regarding savant syndrome.

Savant skills do not diminish or dissolve. A pattern of replication to improvisation to creation is often seen

Savant skills usually do not fade or diminish over time. Savant skills may evolve, and the individual may learn to be creative with their savant skill. An exception is the earlier highlighted case of Nadia, an individual with savant skills whose artistic ability diminished when she was taught more self-help and independence skills (Selfe, 2012; Treffert, 2014). This raises the question of whether savant skills may get substituted for something else resulting from having been taught social skills, such as the attainment of better language abilities, communication capabilities and daily living skills (Selfe, 2012; Treffert, 2014). However, it has been documented that these substitutions do not occur regularly. Alternatively, with continued and sustained practice, the special abilities can persist at the same level or further intensify. Treffert has witnessed a progression in savant skills, especially in prodigious savants whose abilities improve over time and may evolve into that of creativity (Bennett & Heaton, 2017; Treffert, 2014; Treffert & Rebedew, 2015). Based on these observations, Treffert revised his notion that individuals with ASD who have savant skills are not able to be creative or to improvise. He noted that individuals with savant skills can display extraordinary talents and stunning replication abilities, as well as be creative with their savant skills (Treffert, 2014). The pattern of talent development as observed by Treffert begins with the accurate replication of audio or visual subjects. Leslie Lemke, for example, was able to perform Tchaikovsky's first piano concerto perfectly at the age of 14, after hearing the musical piece as a theme song in a televised movie (Strauss, 2014; Treffert, 2014; Wilson, 2016). Leslie's musical talent progressed from literal replication (which he can still do today) to improvisation and creativity. This occurrence may have developed due to his apparent boredom with just reproducing what he had heard (Strauss, 2014; Treffert, 2014). That same transition can be seen in individuals with ASD who display artistic talents. Take for example, the famous artist Stephen Wiltshire who has also been diagnosed with ASD and has experienced many of the challenges associated with ASD. Stephen Wiltshire is able to reproduce in detail what he sees. This was demonstrated in a recent documentary film whereby, after a 45 minutes helicopter ride over Rome, Stephen Wiltshire was able to complete, in three days, an accurate and detailed drawing of the city. A blueprint of the coliseum that was superimposed on his drawing, showed an accurate reproduction of the structure. The clip of the drawing marathon can be seen at www.savantsyndrome.com (Strauss, 2014; Wilson, 2016). Stephen is able to improvise in his drawings, and also construct and create beautiful scenes of his choice. Stephen has published numerous art books and runs his own art gallery in London where he exhibits his drawings (Rieznik & Sigman, 2017; Strauss, 2014; Wilson, 2016).

Savant syndrome is not always associated and is accompanied by low IQ

People are of the impression that individuals who display savant skills must have a low IQ. Although most individuals who display savant skills have IQs of between 50 and 70, there are accounts of some with IQs of 125 or higher (Bennet & Heaton, 2017; Jeon, 2016; Simard-Meilleur *et al.,* 2014; Treffert, 2014). A possible explanation of the low IQ score among individuals with ASD who have savant skills is that some of the test items are verbal. Many individuals with ASD, including those who display savant skills have deficits in their language abilities, especially in the area of verbal skills. This discrepancy in their language ability is an inherent part of ASD (Nader, Courchesne, Dawson, & Soulières, 2016; Simard-Meilleur *et al.,* 2014; Treffert, 2014). Another possible reason for the lower IQ score amongst individuals with ASD is the fact that IQ tests measure only one aspect of intelligence. Savants tend to perform below par on that particular measure of intelligence. Researchers have indicated that there are various ways to measure intelligence and that the IQ test is just one such method. IQ tests measure some aspects of intelligence but may fail to recognize other forms of intelligence that individuals with ASD who display savant skills may possess. Some of the individuals with ASD who display savant skills may appear severely disabled in the abilities measured by IQ. Nonetheless, they are intelligent and gifted in their own right (Nader *et al.,* 2016; Treffert, 2014). The areas of geniuses that individuals with ASD exhibit have led researchers to conclude that there are a series of intelligence, rather than a single intelligence. Others also have suggested the existence of multiple intelligences, which has led to a continued debate among researchers, with regard to the topic of general intelligence versus multiple intelligence theories (Ruthsatz, Ruthsatz, & Stephens, 2014; Treffert, 2014; Treffert & Rebedew, 2015). In all developmental disabilities and savant syndrome, it is important to make a distinction between intellectual disability and functional ability. For example, intellectual disability is categorised by IQ scores, while functional ability refers to instances in which individuals with a regular or high IQ (if accurately measured) function at levels more reliable than individuals with lower IQ scores. IQ tests measure language, verbal discrepancies, social skills and other aspects of intelligence. However, assessments in these areas of intelligence for individuals with ASD may result in scores suggesting a degree of intellectual disability when in fact certain areas of their overall functioning abilities exceed that of a typically developing individual. Leslie Lemke is an example of how IQ scores can be misleading if used as a single measure of intelligence. Leslie has a measured IQ of 58 points on the Wechsler Adult Intelligence Scale – R (WAIS-R) test. It was based exclusively on verbal scores. Performance tests were not conducted on Leslie because such testing is highly dependent on sight and Leslie is blind. Other tests that were carried out on Leslie included the fourth edition of the Stanford-Binet, the Tactual Performance Test, the American Association for Mental Deficiency Adaptive Behavioural Scale, and the Animal List Selective Reminding Test (Strauss, 2014; Treffert, 2014; Wilson, 2016). From the scores of all the various tests, it was concluded that Leslie has a severe intellectual disability. His IQ

was measured at between 35 and 55 (Strauss, 2014; Treffert, 2014; Wilson, 2016). However, by listening and watching Leslie perform, one would realize that he has abilities that surpass that of any typically developing individual. Therefore, in summary, the IQ level in individuals with ASD who display savant skills varies widely from low to high. Having a low IQ is not a prerequisite or requirement for being classified as a savant. While many savants have measured IQ levels below 70, there are other savants who have measured IQs that are above normal, as high as 125 or above (Bennet & Heaton, 2017; Treffert, 2014; Strauss, 2014).

Not all savants have ASD or Asperger syndrome

There are prodigies and geniuses who do not display any traits of ASD and/or intellectual disabilities. Some of these individuals are intelligent and they do not have ASD (Ruthsatz *et al.,* 2014; Ruthsatz, 2014). They have composed multiple symphonies by the age of seven or have become proficient at mastering various musical instruments, sometimes at a young age. Other individuals present extraordinary artistic, mathematical, prose or poetry skills well beyond their years. Children who show these extraordinary types of savant skills and who do not have ASD are categorized as prodigies (Ruthsatz *et al.,* 2014; Ruthsatz, 2014). An adult who displays savant skills and who is not diagnosed with ASD is classified as a genius. Prodigies and geniuses have outstanding abilities in the absence of any underlying disability. Whereby an individual with ASD who displays savant skills usually has one area at a genius level, and a regular prodigy or genius has a high-measured IQ in all areas of their functioning skill levels (Ruthsatz *et al.,* 2014). Just as not every savant has ASD, not every gifted individual has ASD. Instead, the terms prodigy and genius exist as independent settings that are distinct from any fundamental or primary disability or disorder.

There are more males than females with ASD and savant syndrome

There appear to be more males than females among individuals with ASD who exhibit savant skills. There have been reports that males outnumber females by an approximate six-to-one ratio in savant syndrome (Treffert, 2009). By comparison, the estimated male-to-female ratio for individuals with ASD is four to one. Gesch wind and Galaburda (1987) provide a possible explanation for the difference in incidence rates between males and females. Their work on cerebral lateralization indicated that the left hemisphere of the brain usually completes its development and growth at a later stage than the right hemisphere. Thus, the brain is subjected and endangered to prenatal effects. Some of these effects can be harmful if the brain is exposed for a longer period. In the male foetus, the circulating testosterone may stretch to great levels. This may slow down growth and weaken or damage neuronal function in the more vulnerably exposed left hemisphere (Corrigan, Richards, Treffert, & Dager, 2012; Meilleur *et al.,* 2015; Simard-Meilleur *et al.,* 2014; Treffert, 2014). A pathology of superiority was hypothesised in which compensatory development in the right brain was caused as a consequence of damaged development in the left brain (Corrigan *et al.,* 2012; Simard-Meilleur *et al.,* 2014).The research findings of Geschwind and Galaburda (1987) also explain the higher occurrence of other mental and intellectual disorders among males (Floris *et al.,* 2013; Peterson, Mahajan, Crocetti, Mejia, & Mostofsky, 2015; Treffert, 2014). Other learning disabilities, such as dyslexia, delayed speech and stuttering also have a higher incidence among males (Simard-Meilleur *et al.,* 2014; Treffert, 2014).

All savant skills are accompanied by strong memory

Individuals with ASD who have savant skills exhibit strong memory, regardless of their special abilities or talents (Hoffmann, 2016; Hughes et al., 2017; Rieznik & Sigman, 2017). Down (1887) used the term “verbal adhesion” and Critchley (1979) used the term “exultation of memory” or “memory without reckoning” to describe the strong memory exhibited by individuals with ASD. Savant memory is characteristically profound but narrow within the scope of the accompanying special ability (Hughes et al., 2017; Rieznik & Sigman, 2017; Strauss, 2014).

CONCLUSION

Since Down's first account, there have been numerous studies on the cause of savant syndrome. Researchers, including Treffert, have hypothesized that injury to the left brain results in the development of a savant skill (Simis, 2014; Treffert, 2014; Wilson, 2016). Other researchers have commented that when an individual experience frontal-temporal dementia (FTD), savant skills may surface (Simis, 2014; Treffert, 2014; Wilson, 2016). The loss of function in the left anterior lobe of the brain may lead to artistic and music savant skills. For a savant skill to occur, there may be some loss to the left temporal lobe of the brain with the enhanced function of the posterior neocortex (Al-Onizat, 2016; Hoffman, 2016; Kastrup, 2017; Wilson, 2016). Currently, the reason why some individuals with ASD and individuals with intellectual disabilities have savant abilities and talents has not been fully understood. However, there is a strong association between savant skills and ASD as indicated in some scientific research journals. There have been theories put forward, none of which are able to explain the link between savant skills and ASD. Some of the theories include (1) Biological-Developmental - such as genetic, neurochemical, left hemisphere dysfunction, frontal and temporal lobe damage (Al-Onizat, 2016; Hoffman, 2016; Kastrup, 2017; Wilson, 2016) and the DSM IV diagnostic category in Pervasive Developmental Disorder (PDD), (2) Cognitive - such as deficits in executive function and abstract thinking, weak coherence theory, highly developed procedural memory and eidetic imagery (Hiniker *et al.,* 2016; Geurts & Lever, 2017). Other explanations include (3) theory of mind, the ability to think, rationalise, judge and make inferences about the thoughts, feeling and perceptions of other people (Frith, 1989; Hutchins *et al.,* 2016; San José Cáceres, Keren, Booth, & Happé, 2014), (4) compensation for sensory disabilities whereby savant skills are developed in response to the absence of sensory capabilities (especially blindness), (5) social seclusion which offers an environment that allows the individual to maintain focus and develop his or her savant skill, and (6) the modularity of mind hypothesis which suggests that when executive cognitive functions are disturbed, the mind will exhibit a conspicuous modular and segmental organization (Kumar, 2017).

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