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Cognitive load and Asperger's: Teaching relevance

Abstract

This paper examines Asperger's syndrome and Cognitive Load Theory, as well as makes links to teaching relevance and classroom implications. Currently it is recognised that those with Asperger's may have an impaired sensory register (i.e., sensory overload), however, this may also be extended into Cognitive Load Theory. That being, Cognitive Load Theory may present a further understanding of the potential 'overload' occurring in minds of those with Asperger's syndrome (i.e., working memory overload).

Keywords

Cognitive Load Theory; working memory; Asperger's syndrome, education, sensory register, cognitive overload



Cognitive load and Asperger's: Teaching relevance

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This paper examines Asperger's syndrome and Cognitive Load Theory, as well as makes links to teaching relevance and classroom implications. Currently it is recognised that those with Asperger's may have an impaired sensory register (i.e., sensory overload), however, this may also be extended into Cognitive Load Theory. That being, Cognitive Load Theory may present a further understanding of the potential 'overload' occurring in minds of those with Asperger's syndrome (i.e., working memory overload).

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Introduction

In education we often attempt to understand how students best learn, however, when a student's sensory register transfer process to working memory is impaired in any way the student may become cognitively overloaded, and learning becomes hindered due to the limits of the mind (i.e., working memory capacity). The following paper will first define memory, Cognitive Load Theory and Asperger's syndrome; from there a discussion will address how all of these can impact each another to affect a student's ability to learn effectively and efficiently, whilst also addressing classroom implications.

Memory

Memory is concerned with the way in which we are able to retain information over time, through the idea of information processing (Vialle, Lysaght & Verenikina, 2012). Information processing first begins with the sensory register, where information from our current surroundings (stimuli, such as smell, taste, sound, images and touch) is received by the senses – held in the sensory register for a short period of time (two–five seconds) (Howard & Walton, 2015; Snowman, McCown & Biehler 2011). If we apply attention to particular information in the sensory register it will transfer into the working memory, where information is held for approximately twenty seconds and has a limited capacity (Miller, 1994; Snowman, McCown & Biehler, 2011; van Merriënboer & Sweller, 2005; Young et al., 2014). Through use of techniques such as rehearsal and visual imagery, the information in working memory may be transferred into long-term memory, which has a theoretically unlimited capacity – here information is permanently stored (Snowman, McCown & Biehler, 2011).



Cognitive Load Theory (CLT)

The theory of cognitive load was first put forward by John Sweller, being concerned with elements that may overwhelm students as they learn tasks (Paas, Renkl & Sweller, 2004). CLT assumes that humans possess a working memory – in reference to the brain's capacity for temporary storage and processing of information (van Merriënboer & Sweller, 2005; Vialle, Lysaght & Verenikina, 2012). However, working memory has a limited capacity (seven plus or minus two units of information; Miller, 1994), where information is only held for approximately twenty seconds unless attention is applied, allowing the information to be encoded into long-term memory (Miller, 1994; van Merriënboer & Sweller, 2005). Cognitive overload refers to when the learner becomes overwhelmed by the amount or difficulty of the information in their working memory, resulting in difficulty if understanding or ceasing to learn. The overall aim of CLT is to aid the process of encoding information into long-term memory, so that schemas (knowledge structures) can be developed, by avoiding cognitive overload in the working memory (Bingham & Kahl, 2013; Yeh et al., 2012). For example, one technique often used by teachers to reduce cognitive overload is to present information in a way that aids the students in 'chunking' the information and thus managing their cognitive load (Munyofu et al., 2007; Pociask, Morrison & Reid, 2013).

Asperger's syndrome

Asperger's syndrome (AS) is a chronic neurodevelopmental disorder affecting the ability to socially interact and communicate, resulting in a restricted range of behaviours and/or interests (Woodbury-Smith & Volkmar, 2009). Individuals with AS experience some degrees of sensory processing disorder (SPD), that is, their ability to process information through their sensory register is impaired in some form, which affects their ability to respond or engage with their surroundings (Shankar, 2013). People with AS may experience *hypersensitivity* or *hyposensitivity* to any of the five senses; for example, touch resulting in a distinct dislike for particular fabrics (hypersensitivity) (NAS, 2015). Moreover, individuals with AS often struggle to understand their social environment due to their sensory impairment, resulting in a lack of understanding of appropriate social conduct/rules (Dunn, Myles & Orr, 2002; Shankar, 2013).

Connecting the considerations

When an individual is cognitively overloaded, that is, the working memory system is beyond capacity (seven plus or minus two units of information), their ability to learn is impaired (Zhang, 2013). Similarly, when a student's sensory register is impaired in any way, such as through over-responsivity or under-responsivity, learning/understanding may also be impaired (O'Donnell et al., 2012). For example, individuals with AS have noted hypersensitivities and/or hyposensitivities – such sensitivities may be linked to affecting a student's ability to learn and function to optimal performance (Shankar, 2013). This can be seen in Dunn, Myles and Orr's (2002) research, noting that an individual with AS reported that due to their hypersensitivity for smell and touch as a child they were unable to be close to their father due to the smell of his coffee and found the scratchiness of his beard intolerable. This is also known as sensory 'overload', where one or more of the



body's senses (e.g., smell, taste, hearing, sight, balance, body awareness, touch) is experiencing overstimulation, thus impacting the individual's ability to make meaning from the experience (North Shore Pediatric Therapy, 2014). However, the sensory register has unlimited capacity, where everything within an individual's environment is being sensed (e.g., clothes on skin, background noise), however, it needs attention applied for the learner to become consciously aware of it (i.e., has moved into working memory) (Young et al., 2014). This suggests that it is the working memory becoming overloaded rather than the sensory memory, as too much information is being processed from the sensory register/memory and filtering into the working memory, resulting in cognitive overload. For example, one person with AS noted that his sensitivity to suits led to him being unable to work in a job that required a suit, as he was unable to perform his job due to the discomfort of the material (Dunn, Myles & Orr, 2002), suggesting he was unable to focus on any other task as his working memory was overloaded with information from his tactile senses. Moreover, Myles et al.'s (2004) research found over-sensitivity to tactile (touch) resulted in clumsiness and awkwardness for a student with AS.

Understanding may also be impaired when a student's sensory register is *under*-stimulated, for example, Myles et al. (2004) also found that AS students often appeared to have difficulty processing auditory information, thus making social situations confusing/difficult (Dunn, Myles & Orr, 2002). However, it has also been commonly noted for students with AS to have hyper-sensitivities to noisy/loud environments (e.g., Tippet, 2004). Such sensitivities and experiences can result in the student becoming distressed and distant in an attempt to avoid experiencing such hypersensitivities or hypersensitivities, as one individual described it as never knowing "what awful thing may happen next", such as someone touching you or screaming (Menzinger & Jackson, 2009, p. 171). Overall, this suggests that when individuals with a sensory register transfer impairment (i.e., of the transfer process to working memory), such as in those with AS, may result in too much information being forwarded from the sensory register, resulting in the working memory becoming overloaded and impairing ability to learn optimally and effectively. The implication is that there is potential for CLT to further our understanding of the 'overload' happening within the minds of students with AS (i.e., working memory overload).

Educational implications

As with any student, particularly those with exceptional needs, it is important that teachers cater/accommodate for such varying needs (Woodcock, Dixon & Tanner, 2013). One way this can be done is by becoming aware of each student's sensory profile, particularly those on the autism spectrum or with AS, in order to be able to optimally provide for each student's needs (O'Donnell et al., 2012). It is important to note, however, that every child with AS has a different sensory profile; no two children are the same, therefore they will have different sensitivities (NAS, 2014). A sensory profile assessment may be undertaken by a clinician, with the student and parents, from which a report will be created. This, then, suggests the importance of having open communications with parents who have children with AS/autism to ensure the student's needs are being met appropriately (Attwood, 2007). For example, having meetings once a month and an open-door policy in case the student displays



any particular sensitivities or needs at home which may not be evident in a school environment.

Once teachers are aware of their student's sensory profile, providing environments/areas that minimise overstimulation will assist in allowing the student to focus on the desired task (Myles et al., 2000). For example, if a particular student with AS has a hypersensitivity to particular smells, such as coffee or perfumes, avoid wearing perfumes and drinking coffee when near them or, if the student is hypersensitive to touch, avoid having any materials in the classroom that irritates them or allow the use of pens rather than pencils (to reduce vibrations) (MACSWD, 2006; NAS, 2014). For AS students with hypersensitivity to noise, provision of earplugs while working is an option (MACSWD, 2006). Providing students with hyposensitivity to auditory stimuli with visual prompts can aid in communicating instructions effectively, as visual stimuli has been found to be a strength for AS students (MACSWD 2006; Menzinger & Jackson 2009). Menzinger and Jackson (2009) specifically note that it may also be ideal to provide an established 'safe place' for the student/s to go to when distressed/overwhelmed. Providing AS students with a clear programme and warnings of any disruptions (e.g., external noise such as a vacuum cleaner or jackhammer) will aid in decreasing distress (i.e., over-stimulation) by providing the student with the chance to avoid such stimuli. Lastly, it is important that peers are aware of AS students' sensitivities. In a case noted by Menzinger and Jackson (2009), one student with AS became so agitated and anxious by another student's noise that the AS student resorted to violence in order to stop it happening again. Fostering an understanding and supportive classroom is critical, to aid in reducing distress and/or bullying. Such techniques may appear simple, however, they can make a significant difference to the student's learning experience. Students with AS may become tense, anxious, distractible and off-task in sensory-stimulating environments (i.e., the classroom) without appropriate measures being put in place (MACSWD, 2006; Attwood 2013; Menzinger & Jackson, 2009).

Conclusion

As teachers, it is important to be aware of each student's learning needs. In the case of students with AS, it is particularly important to be aware of their sensory profile in order to accommodate appropriately. If this does not occur, a student, particularly one with AS, may have a hypersensitive sensory register resulting in a large amount of information from one or more of the senses filtering into the working memory and might result in cognitive overload and an inability to work effectively and efficiently, thus creating a cessation in information being encoded into long-term memory. Therefore, cognisance of the potential cognitive 'overload' occurring in the working memory of those students with AS needs to be further understood and catered for. For now, current understanding can aid educators in accommodating, through simple but effective strategies, such as avoiding the use of perfumes for students with hypersensitivities to smells and/or allowing the use of earplugs when working if they are hypersensitive to noise. However, open communication with parents and caregivers will also allow the teacher to effectively meet and be aware of the students' needs, because, as teachers, it is our responsibility to support all students' needs so that they may reach their full potential (UNESCO, 2001; Woodcock et al., 2013).



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