

Teaching Computer Science to Students with Asperger's Syndrome

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¹Abstract

As more young people enter higher education, there will be an increasing number of students with physical and mental disabilities. Hidden disabilities like dyslexia, Attention Deficit (Hyperactive) Disorders, (ADD and ADHD), Asperger's Syndrome (AS), and various degrees of reading and learning difficulties can be hard to spot, and university and college teachers are not trained to handle these students. Empirical studies show that there is an overrepresentation of people with Asperger's Syndrome in computer science studies and in the computer industry. There are many programmers with autistic traits, many of whom are autodidacts. The profession attracts Aspergers and others with personality disorders who prefer computers to social settings, and the computer industry would be wise in trying to attract more varied personality types. Aspergers have narrow fields of interest, lack empathy, have difficulties reading other peoples mental states and understanding the needs of others. This causes problems with group tasks, and understanding user needs. The education institutions are being blamed for not being good enough, as they turn out computer professionals with little understanding of user needs. These are serious concerns in an age where focus is on accessible and user-friendly computer systems, user requirements and usability testing and involving users in the development process. This paper presents discussions on Asperger's Syndrome found in sociological and psychological studies, guidelines for pedagogical methods, as well as personal experience with students with Asperger's Syndrome. Some pedagogical techniques based on experience are suggested. Most of these techniques can be beneficial for all students and influence the way computer science is taught.

Keywords: Computer science students, Asperger's Syndrome, special pedagogics, IT geeks, nerds

Introduction

As higher education is becoming available to all, increasing numbers of students with disabilities are entering universities and colleges. For instance, more students with Asperger's Syndrome are entering higher education and a majority of these students are choosing a computer science curriculum. With an increasing number of students with disabilities in computer science, it is important to understand the particular aspects of a disability that will affect pedagogical considerations and social matters.

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Much focus has been on students with physical disabilities, wheel-chair users and the vision and hearing impaired, some on the print disabled and less on the hidden disabilities or personality types like Asperger's Syndrome, a light form of autism. Aspergers are characterized by having a very narrow field of interest, although they are often highly functioning in the sense that they are intelligent, inventive and perform many tasks very well when the environments are adequate. However, they are 'different' in many ways. Dustin Hofman portrays an autistic character in the film 'Rain Man' in a way that suggests Asperger's Syndrome. In many cases the line between Asperger's Syndrome and classical autism is fuzzy, but whereas autists often have a lower IQ than average, Aspergers usually have average or higher than average intelligence. They are overrepresented in the computer industry and in computer science education, and are often named 'geeks' and 'nerds'. They are found amongst artists and scientists. Much indicates that Albert Einstein had AS. In the computer industry it is rumoured that Bill Gates may be a case of AS (Silberman 2001).

Background

Dr Hans Asperger, an Austrian paediatrician, originally described Asperger's Syndrome in 1944. The syndrome has more recently been classified as an autistic spectrum disorder. Autism is associated with 'abnormal social, communication, and imagination development, together with unusual obsessional interests and repetitive behaviour' (Baron-Cohen et al.) A diagnosis of Asperger's Syndrome often matches the criteria for high-functioning autism, meaning that the individual is autistic but has average to above-average language and academic ability, and adequate life skills (Attwood 1998; Baron-Cohen et al. 1999).

Many children and young people are wrongly diagnosed with ADHD or ADD, when in fact they have Asperger's Syndrome. People with Asperger's Syndrome have an intellectual capacity within the normal range, but have a distinct profile of abilities that has been apparent since early childhood. As a teacher of computer science, in a variety of disciplines like programming, networking, ethics and Universal design, I have become aware that the students that are often called 'nerds' or 'geeks' might in fact have light forms of autism like Asperger's Syndrome. Since the computer industry attracts individuals with AS, both autodidacts as well as educated professionals, it is not surprising that there is a large number of students with this disorder. For the lecturer or instructor, it is a challenge to include these students and make adjustments for their special needs. Aspergers have problems with team work, social interactions and collaboration, also in speaking in front of the class. Many teachers have little knowledge and little sympathy with students who do not conform to the 'normal' way of behaviour. Where there is little knowledge there is much prejudice, and such students can be seen as lazy, disobedient, impossible to collaborate with, and some teachers will try by force to make the students collaborate or 'do as they are told'. According to the practice theory of the French sociologist Bordieu the general opinion is that the educational system reflects society, whereas in fact it is not so; the educational system on all levels is autonomous and there is much hidden intellectual violence performed by teachers. (Bordieu).

Asperger's Syndrome affects somewhere between 3.6 and 7.1 per 1000 people and four times as many males as females (Ehlers & Gillberg). For some unknown reason, the number is increasing world wide. 'Studies in the United Kingdom, the USA,

Scandinavia, and Japan indicate that the incidence of all forms of autism spectrum disorders, including Asperger's Syndrome, is increasing' (Rutter, 2005). Interestingly, the numbers of autists and Aspergers are very high in Silicon Valley, and as AS is hereditary, this leads to the supposition that many Silicon Valley workers also have AS. 'Rates of both classic autism and Asperger's Syndrome are going up all over the world, which is certainly cause for alarm and for the urgent mobilization of research. Autism was once considered a very rare disorder, occurring in one out of every 10,000 births. Now it's understood to be much more common. The increase is not due to better diagnostical methods. Certainly one can expect to see many more students with AS in computer science in the future' (Rutter, 2005).

Syndrome Symptoms

People with Asperger's Syndrome 'commonly demonstrate unusual social behaviour such as a disinterest in, and an inability to interact with, peers' (Attwood 1998; Baron-Cohen et al.). They often have little empathy for others and are frequently unaware that their activities may be imposing negatively on others (Attwood, 1998).

Psychological studies (Cohen et al.) indicate that individuals with these disorders can be highly functioning and with high IQ, and that 'folk psychology', i.e. being able to read other peoples facial expressions and body language is independent of IQ. This means that AS students perform well intellectually, but not socially. (Cohen et al.) describe three cases of very-high-functioning individuals with Asperger's Syndrome, two of whom are university students in physics and computer science, respectively, and the third a professor of mathematics. These three individuals were given a test involving reading mental states from photographs of people's eyes. They failed to identify moods and emotions, but showed no deficits on a control task of judging gender from the same photographs. These results 'strongly suggest that theory of mind or folk psychology is independent of IQ, executive function and reasoning about the physical world'.

(Klawe 2001) states that computer nerds 'are often regarded as poor communicators, introverted, and inferior team players, although a number of positive attributes such as intelligence, diligence, good organisational skills, and patience offset these rather negative qualities'.

Dr. Tony Attwood, an Asperger's clinician and author in Brisbane, Australia, defines Asperger's in a way that is more humane than the ordinary classification: 'The [Asperger's] person usually has a strong desire to seek knowledge, truth and perfection with a different set of priorities. ... The overriding priority may be to solve a problem rather than satisfy the social or emotional needs of others.' (Attwood)

According to Attwood, the Asperger syndrome profile includes the following characteristics:

A qualitative impairment in social interaction:

- Failure to develop friendships that are appropriate to the child's developmental level.
- Impaired use of non-verbal behaviour such as eye gaze, facial expression and body language to regulate a social interaction.

- Lack of social and emotional reciprocity and empathy.
- Impaired ability to identify social cues and conventions.

A qualitative impairment in subtle communication skills:

- Fluent speech but difficulties with conversation skills and a tendency to be pedantic,
- have an unusual prosody and to make a literal interpretation.

Restrictive Interests:

- The development of special interests that is unusual in their intensity and focus
- Preference for routine and consistency.

AS Attraction to Computers

A number of case studies demonstrate how and why Aspergers are attracted to computers. Suzanne Carrington and Lorraine Graham (2001) studied a 13 year-old boy whose passion was computing. 'The boy had difficulty forming social relationships, but his knowledge of computers was so extensive that when he applied for a position as a computer consultant the unsuspecting recruitment specialist invited him to an interview'. Newspapers have published stories of how young computer 'wonder-boys' have been hired by IT companies because of their amazing computer skills. What these companies do not take into account is that they will have an autodidact with no social skills on their hands. Aspergers shy away from team work and social settings. They can be great problem solvers, but only for their own satisfaction.

'One of the reasons why computers are so appealing is not only that you do not have to talk to or socialise with them, but that they are logical, consistent and not prone to moods. Thus, they are an ideal interest for the person with Asperger's Syndrome' (Attwood 1998).

In her paper 'High-tech Rascality: Asperger's Syndrome, Hackers, Geeks, and Personality Types in the ICT Industry' Alison Hunter investigated several questions after a serious hacking crime New Zealand which resulted in an acquittal because the hacker had AS. She reflects on whether being a 'computer geek' can be linked to having AS. She also poses the question whether Asperger's Syndrome could be a factor in an apparent lack of concern for harm caused. Research has shown that many hackers have Asperger's Syndrome. They are motivated by the intellectual challenge of hacking, blind to the consequences of their actions. 'Hackers consider themselves 'explorers' rather than public nuisances' (Dreyfus).

Implications for the Computer Industry

People choose their professions or activities on the background of their interests, but also their personality types. Beurocratic institutions do not attract people with artistic and creative minds. Choosing a free profession like the arts or computing lets people escape conformity, in the same way that homosexuals are drawn to the Catholic church

where they escape having to conform to society's expectations of marriage. Aspergers are drawn to computing because they do not have to relate to people, only to machines. They can spend their work days on their own, doing what interests them most.

Asperger's Syndrome in the computer science industry has been described mainly by sociologists and psychologists, less by the computer science community itself. One exception is Maria Klawe who is a computer scientist who states that: 'There's nothing wrong with nerds. Indeed some of my best friends are nerds. Nerds love computer science for its technical challenges, its mathematical structures, and intricacy. Nerds have made wonderful contributions to computer science. But nerds are not enough' (Klawe 2001).

Numerous software design failures are caused by lack of user testing, and little understanding of the work tasks to be performed. But it may be more than that. One of the most appalling examples of badly designed systems that people are forced to use is the relatively new ESS – an Employee Self Service system based on a SAP platform, developed for Norwegian State organizations and used by all state colleges – 'the worst system ever' (Olsen 2010). The system has not been designed for its users. (Olsen) concludes that the system fails because of a lack of professionalism on all levels, and suggests 'low quality educational programs in informatics' or developers who are autodidacts. Colleges and universities therefore have a great challenge when educating computer science students in understanding user needs and design for all, especially when an increasing number of students have AS.

The IT industry itself is aware that of the fact that 'Asperger's Syndrome has been a part of IT for as long as there's been IT'. The link between Asperger's Syndrome, gender, and computers may in some part explain the over-representation of men working in the computer industry, and also explain why women shy away from a profession that is dominated by 'nerds' and 'geeks'. Young women express that that they do not wish to sit at a computer all day long surrounded by young men who all look like Bill Gates. IT companies would be wise to recruit teams composed of various personality types, both the nerds and people with high social skills. Then they may also be able to attract more women.

Two Cases of Students with Asperger's Syndrome

Personal experience with AS students provides some background material for understanding how to identify students who may have the disorder. At university level diagnosis are not made known to teachers unless the students need a special program and an assistant. Many students with AS are undiagnosed, or wrongly diagnosed, so it is often a matter of guess-work from observing the students' behaviour. I have taught one student who was diagnosed with AS, and one whom I strongly suspect had AS although he was not diagnosed, in addition to many students whom I suspect had either ADD, bipolar disorders, or AS. It is hard to tell in many cases when students are very uncommunicative. Teaching such students demands time and patience, but the reward is in the form of their success and sometimes a very unusual and funny sense of humour. I will give a description of two cases.

The case of O.

My first contact with a case of diagnosed Asperger's Syndrome was as teacher in charge of a group of students with diverse learning difficulties on an adjusted art program at a high school in Norway several years ago. The group of ten students consisted of a heterogeneous mix of autists, dyslexics, hearing impaired and students with low IQ and undefined brain damages. The best functioning and by far the most intelligent and interesting student was O. aged 19, who had newly been diagnosed with Asperger's Syndrome. O. was extremely talented in fine arts, but unable to relate to his peers, who also resented him. O. related very well to grown-ups, he was obsessed with word play, which greatly amused his teachers. O. was pleased when he made us laugh. He was very satisfied that he had at last been diagnosed, his upbringing was a long story of school failures, loneliness, resentment from teachers and peers, and rejection from his father who even now refused to accept that O. had a disorder.

O. had a 'normal' appearance, he was quite good looking, and not perceived as odd in any way until one heard him speak. His obsession with words and strange ideas was typical of AS. He would repeat words and phrases over and over until they became nonsensical, and enjoy the sounds. This would get on other students' nerves, and there would be a lot of yelling to make him to stop.

He was a perfectionist, and could suddenly become very angry if he did not perform his tasks well, according to his own standards. He could throw tantrums and scare his fellow pupils. He was aware of his intelligence and looked down on the others whom he perceived as stupid. They, on the other hand found him very weird and abnormal and did not want to be associated with him for instance on outings, visits to art galleries etc. so they would keep a distance and pretend they did not know him.

O. was very talented, both in drawing, painting and sculpture, had a lot of fascinating imagination and always an abundance of ideas. On the other hand, theoretical subject posed great obstacles. He was a poor reader, it is doubtful whether he could understand much of what he read. One of the theoretical subjects was art theory and art history. He would read out loud from the text book, with a low, monotone voice, obviously not paying any attention to the text.

O. would often refuse to do the assigned tasks, preferring to do whatever was in his own mind. The most problematic situation occurred under an exam. He found the task stupid and pointless, became angry, flung his pencils and brushes away, and wanted to leave. It took a lot of coaxing to make him sit through the exam and complete something that could be handed in.

When met with patience and respect, O. worked hard under daily guidance, completed the course and continued his studies at the Academy of Fine Arts. I maintained contact with O. for several years. He is today a successful artist. It is interesting to note that his rather strange behaviour is not perceived as especially strange or disconcerting in the artistic community, and he is highly respected for his work. There are many loners and diverse personality types amongst artists. (Berube, 2007) states that 'One of the most profound mysteries of Autism has been the remarkable ability of most Autistic people to excel at visual spatial skills while performing so poorly at verbal skills.'

The Case of K.

Reading up on AS helps to identify students who may have the disorder. Many students are probably undiagnosed, or incorrectly diagnosed with ADHD, and may even be on medication, the central stimulating drug Ritalin. One example of an undiagnosed student whom I presumed had AS is K., aged 23, whom I supervised on his final bachelor project some time ago. He resembled O. in many ways. His background history was quite similar, with serious difficulties at school and with finding friends.

K. related that at school he was taken out of class and placed in a small group with other pupils who needed special attention. He was never given any explanation why, but spent most of his time making 'waffles' and learnt nothing. After a while he was taken back to his old class, and seemed to get on all right. He said that he had earlier not understood the point of doing school work, but realized that he was going nowhere and with the help of his mother started working seriously at his school tasks.

K. had the typical Asperger's monotone voice, obsession with the program code he was writing, the inability to perform team work; he would do all the work himself, and had difficulties taking instructions and correction when communication was not very clear. He would ask over and over again what he was supposed to do, and explaining could feel pointless after a while, because he would seemingly not take anything in. Correcting his written work had little effect, he would hand in exactly the same text with the same mistakes over and over. When asked why he did not correct the work the way he had been shown, he would say that he did not have the time, or that he had forgotten. He was impatient and always working on coding. Solving problems and making solutions work was the only thing that mattered to him, and the written report was a huge obstacle.

K. had a keen sense of humour. He would ridicule himself and other people, but in a nice way. We got on well because we had great fun and laughed a lot. After a while he depended on our frequent meetings, and he would come into the office quite often just to say hello, or to discuss some trifling matter. It was obvious that he needed the security of our contact. He was always good-humoured, but never asked if I had time, he just presumed I did.

K. worked well under my supervision and obtained a C for his final bachelor project work. He was totally in need of predictability, the frequent supervision meetings, and the security he felt that he could come and talk to me whenever he needed to.

Pedagogical Challenges

There is no cure for AS, and no medication. So how can one teach the Asperger student how to participate in class, or impart how to reflect on user needs, and convey the feelings and moods of others? There are several approaches to these questions.

Recommendations for Pedagogical Approaches in Class

An important point is to not stigmatize the students by treating them differently from other students. A good idea is to start the semester and the first lecture or session by informing the class about disabilities in general; dyslexia, physical and mental

disabilities, and present figures of demographic figures showing that about 25% of the population has some kind of disability, temporarily or permanently. The question of normality should be discussed, and also the ethics of a universal approach to an inclusive society. Experience shows that as a result, students are open about their disabilities and are often frank about having dyslexia, poor vision or some other disability. There is an enhanced understanding of personal differences and variety in the population as a result.

People with AS communicate in different ways than other people. It is important that the instructor understands what AS is and how it hinders students. Actions that are clearly a part of the syndrome can be confused with behavioural issues and dealt with inappropriately. (Jackson 2002). Teachers should adjust their communication to ensure that the student understands what is being said. Messages must be explicit, so that no misunderstandings occur. Language should be straightforward, sentences simple, and not too much information at one time, a challenge for pedagogs who tend to use far too many words to explain matters.

Safran (2002) indicates many of the characteristics of AS can be 'masked' by 'average to above average IQ scores.' This can result in the Asperger student being misunderstood by instructors. Teachers often presume that the student is capable of more than is being produced. 'These are the students who, also able to participate actively in a class discussion, are unable to write a complete sentence. They are the students who rarely have homework completed, or if done, cannot find it. They are light years ahead in math, but reading below grade level. These same students may not only be able to program the computer, but they may be able to take it apart completely and put it back together again. Ask them about the Civil War, DNA cloning, lasers, or ancient civilizations and you might be bombarded with information and unique insights. Ask them to write about the same topic and they may produce little or nothing.' (Shevitz, et al., 2003).

Asperger students are often rejected by their peers. Minority students, Aspergers and students with physical disabilities often find themselves excluded from the student group, and the solution often sought by the instructor is to create project groups from the odd-students out. This is not a good idea. It is much better to let the Asperger students work by themselves, and find other strategies for other groups of students that are left out.

In universities and colleges students are encouraged to be independent and to organize their work on their own. This leads to a high degree of maturity for many students. But because much work is performed in teams, it happens that some students do most of the work, and others are left out or do not participate much. It might be beneficial for all students to do more individual work. This benefits people with Asperger's who prefer experiences that are controllable rather than unpredictable because 'the social world is very hard to control, whilst the technological world of machines is in principle highly controllable' (Cohen et al). So it is a good idea to structure the work and give frequent feed back and provide facilities like a quiet space for Asperger students. If individual work also is a norm, it will not be stigmatizing for students who have problems with team work.

Demonstrating Cause and Effect

(Hunter) states that ‘in my role as a computer ethics lecturer in a large tertiary institution I have noticed that some of my students appear to be captivated by the idea of computer hacking. They typically profess to see ‘nothing wrong’ with hacking. Invariably these are young male students whom I suspect consider themselves to be rather clever programmers’. Ethics should therefore be a part of the computer science curriculum in every subject, and taught as rules for behaviour. Even if all students do not understand why for instance hacking is unethical, they must be told that it is so.

The idea of reinforcement is useful with individuals with AS. Bryna Siegel states that, ‘Although autistic children have difficulty figuring out most principles of human interaction, they are usually pretty astute about cause-and-effect principles, especially in instrumental contexts. This indicates that although a student with AS might be unaware of another individual's desires or emotions he or she is aware of his/hers. This can be useful in education. Once this emotion has been determined the teacher can request the desired behaviour and reinforce the behaviour with the object of desire. Examples of cause and effect can be given as demonstrations, and repeated in different settings, to overcome the problem of the disability to generalize’. (Siegel 1996).

Myles and Simpson (2001) suggest an aspect of learning in the ‘Hidden Curriculum’ that is not obvious to students with AS. This includes the basic knowledge of life in general, things that other people know. This social know-how that tells most people what is inappropriate behaviour, something which is foreign to an AS student. The researchers put forward teachers instructing students struggling in this realm through the use of ‘scope and sequence, direct instruction, social stories, acting lessons, and self-esteem building.’ Social stories and acting lessons give examples of proper actions in given public settings. So role play, the creation of ‘Personas’ and avatars in a social context, for instance in the understanding of users when constructing systems for groups of users can be very valuable.

Psychodrama is an action method conceived and developed by Jacob L. Moreno, MD. Psychodrama employs guided dramatic action to examine problems, and is an effective and powerful method for groups as well as individuals. Psychodrama should only be performed with a qualified instructor. I engaged a teacher of psychodrama in a class of computer students in 2008, and it the session turned out to be very popular. In psychodrama, a conflict situation or problem is described, and the group acts out the situation. Only the students who wish to participate do, the others act as audience. A technique called ‘doubling’ is used, an extra set of actors come on the scene and ‘double’ or stand behind the original actors and carry on their role. Cause and effect can be demonstrated in this way, as well as problem solving and social behaviour. After the session, there is a closing, where the group discusses what happened. All these techniques are beneficial to all students, not only to Aspergers.

Guidelines for Teaching Students with Asperger’s Syndrome

In college, as opposed to in school, there is no higher authority ensuing a student's best interests. Because the disorder is invisible and AS students look like other people while

not being able to relate to their peers, many are left to themselves. However, some universities are experts on students with AS. One of them is the university of Leeds. They have several recommendations for students with disabilities, and guides for downloading on how to cope with AS students. Their web-pages are beautifully designed and accessible to all. Pdf files for downloading are : ‘Aspergers syndrome, brief guide for staff’, and ‘Aspergers syndrome, more detailed guidance’.

Some suggestions for adjustments are referred here, they are generic, rather than student-specific, recommendations:

General adjustments:

- Identify a quiet place for retreat - students with AS often find noisy environments overwhelming which can lead to anxiety
- Identify where the student can go for help with course-related issues - again, set clear boundaries and guidelines for contact

Learning & teaching adjustments:

- Establish a clear line of communication to inform the student of changes in routine (e.g. room changes, if a lecturer is off sick etc)
- The student may need the links between aspects of learning to be made explicit as generalising across contexts can sometimes be problematic. For example, they may not intuitively transfer skills learnt in one area of the course to another
- Accommodate different learning and thinking styles by using visual strategies and multi-sensory approaches when planning lectures and seminar
- Offer to provide the student with hard copies of PowerPoint slides and information published on the VLE, prior to taught sessions. Check that the student has received these, and that they are understood
- Provide the student with support from course staff in ensuring that instructions and deadlines are very clear and assignment briefs are specific
- Consider granting the student permission to work alone rather than in a group. If group work is essential, help may be required with choosing partners
- Arrange frequent meetings with their personal tutor to check progress

Assessment related adjustments

- Consider allowing the student additional time for coursework and assignments
- Advise the student when the work done is good enough, and of sufficient quantity: perfectionism is a trait of AS
- Give clear, constructive feedback to avoid causing anxiety (for example, explaining explicitly that a mark of 76% is a good mark)
- Avoid assessing by oral presentation if this is unnecessary: students with AS may have difficulty with such presentations (if presentations are used, they should normally be assessed for ideas, knowledge and ability to address problems, and issues with style, such as speaking too fast, should be discounted)
- Ensure that the student is very clear about what is expected and the amount of time it is advisable to spend on each section of an exam
- Student may require extra time in examinations and time-bounded assessments.

Future Work

Much has been said about badly designed and malfunctioning computer systems, less about the personality of the programmers responsible for code and design. To give a programmer with AS a program design, models and descriptions is like giving a product designer a written description: it will not be understood because the designer is often dyslexic. A software developer with Asperger's cannot generalize, will have no understanding of abstract models or of the end user, and will solve problems according to his own head. The software industry is full of clever programmers with no social skills, empathy or understanding of users. Individuals with AS are likely to contribute to communication difficulties and make ethical mistakes. The computer science community should conduct further research in this field, as the numbers of AS students and professionals is increasing, something which will have implications for how programming and development should be taught.

The reflections in this paper are also interesting when considering the numbers of young men who drop out of school and higher education and especially out of computer studies. Several universities and colleges lose many computer science students both on bachelor and masters programmes, but nobody has seriously studied if there may be a connection between the students who drop out and personality types like ADHD or AS. This is a theory well worth looking further into. If there is such a connection, then it is necessary to give many students more attention and feed-back. Paradoxically, it is in the first year of studies that the students have the least contact with their teachers. The introductory courses are large with tens and even hundreds of students, and to Asperger students it must seem overwhelmingly confusing and frightening.

Further, there is no evidence of empirical studies showing that university or college teachers in general have any training in understanding hidden disorders. Unqualified teachers may in some cases be given the task of 'taking care of' students with special needs. At Oslo University College there was recently case of a young man diagnosed with Asperger's Syndrome who needed special attention and help, and the job was given to a teacher who had no qualifications for this sort of work, being neither a teacher in special pedagogics nor an expert in computer science. The strategy naturally proved very unsuccessful, and the student disappeared after a while. Training teachers in understanding diverse personality disorders must be taken seriously.

Conclusion

Students with Asperger's Syndrome are often called 'geeks' and 'nerds', and are found in numbers in the IT industry. Since autism is increasing world wide, Asperger students will increase in numbers in studies of computer science. Identifying students with this personality type and adjusting environments and pedagogics to help these students will improve their learning, and the general knowledge about the disorder amongst instructors. Teachers with no training in understanding hidden disorders do little good to AS students. With the increasing numbers of AS students of computing in mind, it is important to understand what AS is, and acquire knowledge of methods that are efficient when dealing with AS students.

Recognizing that the computer industry has a large number of people with Asperger's Syndrome may turn the attention to some of the reasons for many design failures in software. Changing the way to teach computer science will benefit all students and in turn the computer industry, as hopefully more varied personality types will become attracted to the profession. The industry needs more professionals of a high ethical standard, who can communicate with diverse users.

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