

# Characterization of Programmers with Dyslexia

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**Abstract.** Computer programmers with dyslexia can be found in a range of academic and professional scenarios. Dyslexia may have the effect on a computer programmer of degrading the expected results during collaborative software development. These people may perform better using visual programming languages. However, we need to understand what programmers with dyslexia experience in order to be able to come up with possible solutions. We have conducted an analysis of existing literature and a survey on dyslexia and programming. This paper reports the preliminary results based on the data gathered so far and the key characteristics and needs of this group with the aim of defining the profile of computer programmers with dyslexia.

## 1 Introduction

Changes in inclusion due to policies such as the Convention on the Rights of Persons with Disabilities [1], make it possible for persons with dyslexia to become computer programmers. Dyslexia is a specific reading disorder, where “Reading comprehension skill, reading word recognition, oral reading skill, and performance of tasks requiring reading may all be affected. Specific developmental disorders of reading are commonly preceded by a history of disorders in speech or language development” [2].

A computer programmer with Dyslexia may have a degraded performance using traditional programming languages and may perform better using visual programming languages. However, we need to understand their profile as programmers in order to come up with possible solutions. So, an analysis of the literature and an electronic survey have been conducted.

## 2 Related Work

There is literature and software applications aimed at helping children with dyslexia. However, dyslexia among software developers has not been much researched, and we have not come across any software tool designed to help computer programmers with dyslexia in the process of creating computer programs.

A literature review has identified two relevant studies. The first claims that dyslexic programmers usually come up against a number of difficulties when developing software [3]: remembering code details, sticking to a good code presentation layout, correctly defining variables correctly and being at coding and at debugging... However this group of people have a great capacity for analysis, as usually they have an IQ above the average. The second study describes problems associated with dyslexia in the programming area in higher education [4]. They confirm problems described by [3] and they provide some accessibility guidelines for programmers with dyslexia.

Afterwards, we have identified the characteristics of adults with dyslexia [5]: they may have different learning-related symptoms, which show up as problems with reading, writing, organization, speech or mathematics. They may experience visuospatial difficulties (problems with mathematics, reading, writing and organization), speech sound difficulties (problems with speaking, reading, writing and organization) and correlating difficulties (problems with writing).

### **3 Results of the Survey**

We have built a survey to determine the profile of computer programmers with dyslexia. The survey has been answered by Spanish-speaking computer programmers selected by a combination of convenience sampling and purposive snowball sampling. They were inquired sociodemographic, behavioral and programming variables [6].

The sample of 155 programmers had an average age of 22 years (from 20 to 44). 6.5% of all respondents believe that they are dyslexic (n=10). Of this group 40% consider that dyslexia has a negative effect on their programming performance. It is striking that only 20% of these 10 have been professionally diagnosed as being dyslexic, which probably means a lack of awareness and proper treatment of this disability.

Regarding behavioral variables (table 1), we found that 70% of computer programmers with dyslexia suffer anxiety when programming compared to 37.9% of programmers without dyslexia. Poor concentration does not appear to be a problem in the surveyed sample, as stated by 80% of computer programmers with dyslexia and 68.3% of programmers without dyslexia. However, these data contrast with the 60% of programmers with dyslexia and the 50.3% of programmers without dyslexia that responded that they were easily distracted when studying. On the other hand, 50% of the programmers with and 61.3% of the programmers without dyslexia stated that they do not often suffer mood swings. With respect to depression, 90% of the programmers with and 78.7% of programmers without dyslexia do not suffer from this. 60% of people with dyslexia in contrast to 23.4% of those without dyslexia consider themselves anxious persons. We also observed that 80% of programmers with and 68.3% of programmers without dyslexia do not suffer from insomnia. We found that 50% of programmers with and 55.2% programmers without dyslexia have trouble getting up in the morning.

In regard to programming activity, only 30% (n=3) of programmers with and 20% (n=29) of programmers without dyslexia have ever used a visual programming language. We found that 66.6% of programmers with dyslexia state that they make more mistakes programming using a textual language against 33.3% who state that they make

more errors using a visual programming language. Table 2 shows the most representative data with respect to programmer preference for, ease of use of and speed using a visual language.

We have applied a chi-squared test to the variable “Do you think you are dyslexic?” with all the behavioral variables. We found that there is a statistically significant relationship for the variables: behavior to get attention ( $p=0.02$ ), compulsive behavior ( $p=0.016$ ), excuses for not going to school ( $p=0.03$ ), programming hypoactivity disorder ( $p=0.026$ ), frequent state of isolation in programming ( $p=0.047$ ), hyperactivity disorder ( $p=0.019$ ), anxious behavior ( $p=0.01$ ) and distorted vision ( $p=0.0$ ).

**Table 1.** Percentages of disagreement with respect to behavioural variables.

Percentage of disagreement with respect to behavioural variables (n = 155)	PwithD (n = 10)	PwithoutD (n = 145)	P
I often made any number of excuses to get of going to school	80.0%	86.2%	0.030
I now often make excuses to get out of going to work or university	80.0%	83.5%	0.618
I often resort to attention-seeking behaviour	70.0%	85.5%	0.002
I often suffer episodes of irritability	40.0%	61.4%	0.196
I consider myself to be an aggressive person	80.0%	83.5%	0.065
I consider myself to be a withdrawn person	90.0%	67.6%	0.420
I consider myself compulsive person	50.0%	55.2%	0.016
I like to be isolated from others	60.0%	62.1%	0.817
I consider myself hyperactive person	40.0%	64.8%	0.019
I am often unhappy	50.0%	71.7%	0.270
My self-esteem is low	60.0%	60.7%	0.899
I suffer from disordered vision	70.0%	95.9%	0.000
I often suffer from fatigue	40.0%	66.2%	0.143

**Table 2.** Characteristics of affinity for visual programming

Affinity for visual programming (n = 32)	PwithD (n = 3)	PwithoutD (n = 29)	p
I prefer a visual language	66.7%	24.1%	0.746
I find a visual language easier to use	66.7%	34.4%	0.933
I program faster with a visual language	66.7%	48.2%	0.869

## 4 Analysis of the Results

The percentage of the sample (6.5%) stating that they believe that they are dyslexic is the range of adult population with dyslexia that goes from 5% to 10% [7].

It is usually considered that adults with dyslexia have obvious symptoms of low self-esteem and no confidence and feel helpless in some life situations [8], but the result for these variables, after applying a chi-squared test, confirm that these emotional variables do not play a role in defining their profile. The percentages related to performance, preference and ease of use of textual programming languages [3] confirm claims that programmers with dyslexia using programming tools with visual or graphic support are 20% better than programmers without dyslexia at developing computer programs. We

did find that programmers with dyslexia make fewer mistakes than programmers without dyslexia when using a visual programming language.

## 5 Conclusions and Future Work

The emotional characteristics proposed in [8] to define the profile of adults with dyslexia seem not to be relevant to define the profile of programmers with dyslexia. However, further research is required to explore other variable types.

We have also found that programmers with dyslexia have a preference for visual programming, as also explained in [3], and they claim to make fewer mistakes.

We intend to gather more replies to our survey, by sending it to programmers in other Spanish-speaking countries and to programmers that belong to associations of persons with dyslexia. Then we plan to broaden the spectrum and perform the same study with English-speaking programmers to get a broader understanding of issues.

In the long term, and with the aim of counteracting the performance differences in interactive programming, we propose to design a two-way visual and textual code transformation model. The goal is to develop software on a single interface that inter-acts between the two codes, providing support for programmers with dyslexia in the process of interacting with their teammates.

## References

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