Dyslexia and Substance Use in a University Undergraduate Population

Background: A number of cognitive deficits are associated with dyslexia. However, only a limited amount of research has been performed exploring a putative link between dyslexia and substance use. As substance use is thought to involve a cognitive component, it is possible that the pattern of substance use would be different for dyslexic participants, when compared to non-dyslexic controls. During the current study a guiding hypothesis was that people with dyslexia would demonstrate less substance use than non-dyslexic controls. Theories of memory activation, automaticity, and attentional bias in substance use suggest that cognitive components of substance use are important in the development and maintenance of continued substance use and it is thought that, at least some of these components, would be impaired in a dyslexic population.

Objectives: If the cognitive deficits displayed by dyslexics somehow impair the development of cognitive components of substance use, substance use for dyslexic participants may be less pronounced. This paper therefore examines this hypothesis by comparing substance use within dyslexic and non-dyslexic participants, from an undergraduate population.

Methods: This was an exploratory questionnaire-based study. Dyslexic participants (n=35) were compared to control participants (n=62) on a series of questions designed to measure their substance use history.

Results: The results provided preliminary evidence of a difference between dyslexic and non-dyslexic substance use. Dyslexics reported a substance use history that was significantly lower than non-dyslexic controls.

Conclusions/Importance: These results are interpreted in terms of cognitive deficits within dyslexia and with reference to the cognitive model of substance use.

Key words: Dyslexia; Substance Use; Attentional Bias; Automaticity; Memory Activation.

Dyslexia and Substance Use in a University Undergraduate Population

Dyslexia is a condition which affects 5 – 17.5% of the population (Shaywitz, 1998). However, there have been very few studies of co-morbidity between dyslexia and other population characteristics. For example, some controversial research appears to suggest that dyslexia has a positive relationship with criminality (e.g. Critchley and Critchley, 1978). Grigorenko (2006) also suggests that the link between schooling experience, academic achievement, and delinquency is strong. This suggests that those who do not perform well in school may be more susceptible to criminality. Indeed Kirk and Reid (2001) observed that 50% of a sample of young offenders from a young offender's institution in Scotland had dyslexic traits. The presence of dyslexia is higher amongst young offenders than what is typically the case in a non-dyslexic normal population (see also Jensen, Lindgren, et al., 1999; Dåderman, et al. 2012; Macdonald 2012a; 2012b). Matson and Haglund (2000) also found evidence to suggest that a delay in reading development was associated with a number of risky behaviours, including substance use. Of course, in such observations no causal link is implied, nonetheless they are quite important for relevant practice.

Of interest in the current paper is the co-morbidity between dyslexia and substance use (the latter broadly defined, to include common substances, such as alcohol, and less common ones, such as illegal drugs). In general, substance use has been found to be higher amongst youth offenders than a comparative non-offender sample (Hammersley, Marsland, and Reid, 2003), so perhaps the above observations might lead to an expectation of an association (perhaps weak, overall) between substance use and dyslexia. As demonstrated later, speculative theoretical reasons might lead to the *opposite* prediction as well. Either way, the idea that dyslexia could lead to different patterns of substance use, if supported, would have implications for current practice. The main objective is to provide pilot data which bear on this issue, as well as a preliminary theoretical background, which can motivate some relevant predictions. As far as the authors are aware, there have been very limited previous examinations between dyslexia and substance use. One exception is the study by Yates (2012), who found a relationship between dyslexia and addiction. Yates suggests that dyslexia is overrepresented (40%) in his sample of people with addiction issues in Scotland. The present study aims to build on this work, by examining a similar association, in a sample of exclusively university students, at a UK institution.

Developmental dyslexia is considered an impairment in reading competency, without impairment in IQ, neurological damage, or when the individual has had adequate educational opportunities. In essence, it is a reading condition that is not the result of intelligence or learned behaviour. A number of theories have been suggested which attempt to explain the development of dyslexia. Theories such as phonological deficit (e.g. Vellutino, Fletcher, Snowling, & Scanlon, 2004), magnocellular deficit (Ray, Fowler, & Stein, 2005), perceptual-noise exclusion deficit (Roach & Hogben, 2007), and automaticity deficits (Nicolson & Fawcett, 1990) have all received various levels of support and criticism. However, regardless of how dyslexia may develop, there would appear to be an underlying cognitive component affecting a number of cognitive domains as dyslexia is characterised by much more than just a problem with reading and phonology (e.g. Bradley & Bryant, 1983; Frith, Landerl, & Frith, 1995; Stanovich, 1988). Dyslexia has also been found to be associated with problems in memory (Liberman, Mann, & Shankweiler, 1982), visual processing (Eden & Zeffiro, 1998; Pavlidis, 1991; Stein, 1990), auditory processing (Tallal, 1980), and attention (Casco, Tressoldi, & Dellantonio, 1998; Facoetti, Paganoni, Turatto, Marzola, & Mascetti, 2000). So how could a population demonstrating such problems with cognition demonstrate different patterns of substance use than non-dyslexic populations?

There are three possible ways in which these cognitive deficits could impact on a cognitive component of substance use. Perhaps, the problems of dyslexics with memory, attention, or automatisation, contribute to different substance use behaviour. Theories emerging from cognitive science would predict that discrepancies in memory activation, attentional biases, or automaticity, could lead to different patterns (or propensities for) substance use.

First, memory activation of relevant information may support substance abuse (see Stacy, 1997). Outcome expectancies, cognitive processes involving memory activation, have been found to be associated with substance use. Those who display strong positive outcome expectancies are more likely to continually engage in substance abuse behaviours. This is due to the fact that positive memories regarding substance abuse may be more readily accessible. Therefore, those with poorer memories, e.g. dyslexics (see Maehler and

Schuchardt, 2009), may demonstrate less activation of relevant expectancies, which may lower corresponding biases for substance use.

Second, automatised behaviours are those which do not require cognitive effort and attention to be activated. Tiffany (1990) suggests that compulsive substance use may be an automatised behaviour itself, as substance taking behaviour is, in effect, 'practiced', due to a repetition of substance-specific motor and cognitive actions. This suggests that a number of 'cognitive shortcuts' are established with repeated substance use, which enable 'easier' subsequent substance use behaviour. In the presence of a triggering stimulus, a substance user may spontaneously engage in substance use behaviour, as this pattern of behaviour has become automatic. This suggests that an impairment in automaticity development, as it has been hypothesized to be the case for dyslexics (e.g. Nicolson and Fawcett, 1990), could be associated with decreased substance use behaviour.

Third, attentional bias for information relating to an abused substance (here and elsewhere we will refer to such biases as just attentional biases: e.g. Cox, Fadardi, and Pothos, 2006; Pothos and Cox, 2002) is a characteristic of substance use, which is thought to be learnt and is thought to relate to automatically activated information relevant to a used substance. An attentional bias is an increase in attention for a certain stimulus. For example, alcohol-related attentional biases have been found to be important in the maintenance of alcohol abuse. Indeed, the strength of alcohol attentional biases can be a good predictor of future alcohol use (e.g. Cox, Pothos, Hosier, 2007). If dyslexic participants have impaired attentional processes (e.g., Facoetti et al., 2000) or impaired learning processes (cf. the putative difficulties with automatisation, hypothesized for dyslexics; Nicolson & Fawcett, 1990) they may be less likely to develop attentional biases related to substance use.

Overall, it is not necessary to further speculate as to which cognitive theory of substance use could putatively be involved in dyslexia specifically. However, we think that the cognitive deficits associated with dyslexia provide sufficient motivation to broadly consider substance use in dyslexics. Specifically, from research on memory activation, automatisation, and attentional biases in substance use and research on cognitive problems associated with dyslexia, the following preliminary hypothesis can be motivated, that persons with difficulty in the some (broadly) relevant cognitive skills (such as dyslexics) may be less susceptible to substance use problems. The cognitive approach to dyslexia (and

substance abuse), that we favour, recommends this hypothesis. Clearly, an alternative hypothesis can be motivated too, as Yates's (2012) research, namely that there is a positive relationship between dyslexia and substance abuse, because of social economic status discrepancies, relating to dyslexia. In Yates's research, it was suggested that there was an overrepresentation of dyslexia in a sample of substance users. A third, null hypothesis, is that there will be no association between dyslexia and substance abuse.

In the present research, we decided to adopt a questionnaire approach, as our intention was to provide an exploratory test of the basic idea that there might be an association between dyslexia and substance use. The questionnaire approach has advantages in that it allows us to explore several substances concurrently in an efficient way – in a way, such an approach sacrifices depth for broadness, but it is the latter which is needed for this study. We note that clearly our ideas are not specific enough to make fine predictions of whether there may be a dyslexia effect for one particular substance, but not another. No doubt, substance use (and abuse) for dyslexic individuals will be a complex function of many factors, other than the cognitive ones we consider here, such as motivational ones etc. A consideration of these additional factors could perhaps be employed to provide more specific hypotheses, but this is not our purpose here. Rather, we want to provide baseline, essential data regarding possible relation between substance use and dyslexia, which would guide both future more thorough empirical studies and relevant theorising (cognitive or otherwise). Within the present research the hypothesis under investigation is whether dyslexics are less susceptible to substance use problems. It is predicted that dyslexics will report less substance use behaviour in comparison with controls.

Method

Participants

98 participants were recruited. However, one participant was removed from all analyses because his/ her scores were over 8 SDs away from the mean on the 'substance use' variable (see below); the rest of the participants were within 3 SDs of the mean on all variables, resulting in 97 participants' results being used in the analyses (overall: 35 dyslexic, 62 non-dyslexic controls; 28 males, 69 female; note, there was an adequate number of

participants in all cells of the design: 11 dyslexic males, 24 dyslexic females, 17 control males, 45 control females). All participants were university students (mean age for males: 21.5 years, for females 22.3 years). Dyslexic participants were recruited with the help of the Swansea University Disability Office. The dyslexic participants had all been previously diagnosed with dyslexia by an educational psychologist. However, regardless of this diagnosis, we also confirmed dyslexia diagnosis with a further measure (see below). Controls were obtained by offering psychology students subject pool credit. Dyslexic participants volunteered to take part in the study. Participants were informed that full ethical permission had been obtained from Swansea University.

Materials

Substance Use Questionnaire: This was a slightly modified version of the UEL (University of East London) Drug History Questionnaire (Parrott *et al.*, 2000a). It is a fairly established measure for the collection of self-reported substance use frequencies. The questionnaire was deemed suitable for this study, as frequency of substance use was the primary concern. This questionnaire asks participants to report the frequency with which they estimate to have used 15 different substances during their lifetime: alcohol, nicotine, cannabis, ecstasy/MDMA, amphetamine, cocaine/crack, LSD, barbiturates/benzodiazepines, opiates, magic mushrooms, anabolic steroids, solvents, poppers, ketamine, and Prozac. Participants responded with a 'Yes' or 'No' response denoting whether they had used the substance, together with an estimate of how many occasions the substances had been taken. For example, 'Which of the following drugs have you taken and approximately how many times in your life time?'. All questions were of a similar format. Note, we measured Cronbach's α to assess the reliability of responding in our sample. The estimated reliability was 0.82 which demonstrates a high level of reliability.

Clearly, the questionnaire can potentially lead to several independent variables regarding substance use. However, as noted in the Introduction, we do not seek to discriminate between different substances in the present investigation. Rather, we want to examine putative differences between dyslexic and non-dyslexic participants, in substance use, *in general*. So, we collapsed individual substance use variables into one score of 'substance use'. Specifically, the z-scores of the 15 substance use frequencies were added together in order to obtain the single 'substance use' variable. Note, within the control

participants, the substance use rates we observed were broadly analogous to those reported for university samples in other studies. For example, if we consider MDMA, Webb et al., (1996) found 13% of British university students reported taking MDMA which is similar to our sample which reports 17% usage. Rogers et al., (2003) which used the same outcome measure as in the present study, the UEL drug history questionnaire, observed 32% MDMA use in a sample of young, educated people. Levels for other substances considered within this paper were also broadly analogous to other studies (see Bewick, et al., 2008 for alcohol; Steptoe, et al., 2002 for smoking; Webb, et al., 1996; and Barrett, et al., 2006 for cannabis, LSD, amphetamines, cocaine, ecstasy, magic mushrooms, heroin, and steroids).

Potential for Alcohol Addiction: The CAGE questionnaire (Ewing, 1984; O'Brien, 2008) is a measure of potential for alcohol addiction. This is a clinical measure used to screen patients for an addict-type personality and is an effective measure of alcohol use. It consists of four questions: 'Have you ever: a) Felt the need to *cut* down on your drinking; b) Felt *annoyed* by criticism of your drinking; c) Had *guilty* feelings of your drinking; d) Taken a morning *eye* opener?' Participants respond with a 'yes' or a 'no'. Participants' responses were scored out of four and this produced a variable for potential for alcohol addiction. We computed Cronbach's α was used, which was 0.68, indicating a fair amount of reliability in responding within our sample.

Dyslexia Questionnaire: The Adult Dyslexia Checklist (Vinegrad, 1994) was administered to examine dyslexia symptoms (note again that all dyslexic participants were recruited from the Disability Office, which had already provided a dyslexia assessment). This correlates strongly with formal dyslexia diagnosis (e.g. Turner, 1997). It consists of a list of 20 questions, which can be answered with either a 'Yes' or 'No' response. 'Yes' responses are associated with dyslexic traits and the overall number of 'Yes' responses indicates a higher likelihood of dyslexia. For example, 'Do you have trouble telling left from right?'. Scoring the questionnaire consisted of calculating the total 'Yes' responses out of 20. Cronbach's α was used to measure the reliability of the checklist. The estimated reliability was 0.89, showing a high level of reliability.

Procedure

Participants were emailed the questionnaires and a consent form. The questionnaires were implemented in Excel spreadsheets, and participants recorded their responses within these spreadsheets. The questionnaires took between 5-10 minutes to complete. Upon completion, participants could either email their responses to the experimenter or print them and send them via mail. Either way, all data was recorded in a completely anonymous way.

Results

Participants who had previously been diagnosed with dyslexia scored differently to controls on the Adult Dyslexia Checklist (ADC). The proportion of 'Yes' responses were .57 (SD: .18) for dyslexics and .17 (SD: .15) for controls, a difference which was highly significant ($t(95) = 11.636$; $p<0.0005$; $d=2.39$). This comparison confirms our assumed dyslexic vs. non-dyslexic group distinction. Thus, the participants recruited as dyslexics from the Disability Office displayed more dyslexia symptoms, according to the ADC. Note, there was no significant difference between males (.26; sd=.25) and females (.34 sd=.25) in terms of the dyslexia scores, t(95)=1.330;p=.187;d=.299.

The distinction between dyslexic and non-dyslexic controls was used as an independent variable to examine its effect on substance use. A between-subjects ANOVA was performed with two between-subjects factors, dyslexia group and gender (the latter was included to take into account possible gender differences in substance use; e.g. Becker and Hu, 2008). The dependent variable was 'substance use', defined as above. There were significant main effects of dyslexia ($F(1, 93)= 8.455$; $p = .005$; $n^2=.083$) and gender ($F(1, 93) = 14.703$; $p < .0005$; $n^2=.137$), as well as a significant interaction, $F(1, 93) = 4.530$; $p =.036$; $n^2=.046$. Figure 1 demonstrates the interaction of dyslexia and gender on substance use. Levene's test for the homogeneity of variance was significant ($F(3,93)=29.198$, $p<.0005$), so in the relevant post hoc contrasts we employed the corrected t-statistic for unequal variances. For female dyslexic participants (m=-.28;sd=.11), the difference in substance use profile differed significantly from that of nondyslexic females (m=-.19;sd=.24), t(65.9)=2.139;p=.036;d=.48. Male dyslexic participants (m=-.09;sd=.31)

demonstrated a marginally significantly different substance use profile to nondyslexic males (m=.49;sd=1.09), t(19.8)=2.050;p=.054;*d*=.72 (note, uncorrected degrees of freedom for females were 67, for males 26). The difference between dyslexics and non-dyslexics is further illustrated in Figure 2. There is an overall trend that, for the majority of substances, use for non-dyslexic controls is higher than for dyslexic participants.

Regarding CAGE, which, recall, measures an individual's potential for addiction, a between-subject ANOVA was performed with two between-subjects factors, dyslexia group and gender; the CAGE responses were the dependent variable. Although there was a significant main effect of gender ($F(1,93) = 10.055$; $p = .002$; $n^2=.098$), there was no significant main effect of dyslexia ($F(1,93) = 1.079$; $p = .302$; $n^2=.011$), and no significant interaction ($F(1,93) = .001$; $p = .971$; $n^2<.001$). These null results may be due to the clinical nature of the questionnaire, as this measure is usually used for chronic addiction problems, so may not be sensitive enough for detecting differences in the drinking behaviour of undergraduate students.

Discussion

This study provides some support for the hypothesis that dyslexic participants have a different pattern of substance use than non-dyslexic ones, in that non-dyslexic participants reported a significantly lower frequency of substance use, compared to dyslexic ones. This in turn lends some credibility to the idea that, perhaps, the cognitive deficits associated by dyslexia may also reduce cognitions related to substance use, hence reducing substance use (cf. Tiffany, 1990). We reiterate that, currently, this idea is speculative. Regardless, the present results do reveal an interesting direction for future work, in relation to differences between dyslexic and non-dyslexic individuals, for substance use and, equally, corresponding cognitive science.

In our sample, as it happened, female participants demonstrated an overall low level of substance abuse. There could potentially be a number of reasons which could explain the gender differences. One possibility is that this difference simply reflects random sampling variation. Another is that there is a genuine gender-related source of individual differences, in substance abuse, in the relevant population (undergraduate students at Swansea

University). A third possibility is that perhaps female participants were more reluctant to report substance abuse (even given the anonymity guarantees that we had in our study). It seems clear that more detailed methodology is needed before we can confirm or disprove any of these possibilities.

The results obtained in this study would seem to contradict those of Yates (2012), who observed increased substance use in a dyslexic population. However, the differences in the conclusions between our two studies can be accounted for by differences in the population sample. All our participants were university undergraduates, at Swansea University. Although we did not collect information on the socio-economic status of our participants, students at Swansea University, and university students in general, are often from parts of the community representing relatively higher levels of socio-economic status. By contrast, Yates (2012) focused on a population of young offenders. So, his finding of a higher proportion of dyslexic participants in his population is (in principle!) consistent with our finding of lower substance abuse rates for dyslexic participants, in our sample of university students. One speculation we offer here is that dyslexic individuals with higher socioeconomic status may be more motivated (and more successful) in finding ways to compensate for any disadvantages associated with dyslexia. Indeed, Macdonald (2009; 2012) suggests that lower socio-economic status and dyslexia are pathways to offending. Notwithstanding these points, our results and Yates's (2012) results clearly point to a need to consider socioeconomic factors in future investigations on the relation between dyslexia and substance abuse.

Note, we do acknowledge that employing only university students is an important limitation in any conclusions from this study. Indeed, some of the related interesting hypotheses concern populations which we expect to be dissimilar from university students, such as offenders (e.g. Kirk & Reid, 2001) and, clearly, extensions need employ a more representative population sample. Other limitations of the present work included that dyslexia was established indirectly, by employing the classification from the Disability Office at Swansea University and the ADC. Ideally, a direct empirical assessment of dyslexia would be carried out. However, we have confidence in the present identification of dyslexic participants, as the Disability Office is required to employ rigorous procedures. Also, one

hypothesis for the difference between dyslexic and non-dyslexic participants concerns the lack of ability of dyslexic participants to develop attentional biases related to substance use. An explanation based on memory might suggest that dyslexic individuals are less able to recall past incidents of substance use (there is extensive research that memory activation of relevant information may support substance use; e.g., Stacy, 1997, but see Maehler and Schuchardt, 2009) and an explanation based on problems with automaticity development would predict a disconnect between frequency of substance use and the development of related attentional biases (but see Bishop, 2002). However, it is beyond the scope of this paper to suggest which cognitive process *specifically* could be the underlying mechanism contributing to the observed results.

Non-cognitive possibilities for the present results include differences relating to self-awareness and motivation (which may relate to socioeconomic status; cf. Yates, 2012). Perhaps dyslexic individuals are more self-aware and so less likely to report socially undesirable behaviours. But, undermining this particular explanation is the finding of Frederickson and Jacobs (2001) that the self-perception of dyslexics is the same as their non-dyslexic peers. Also, Sparks *et al.* (2008) found no difference in motivation between dyslexics and non-dyslexics in foreign language learning, though of course this does not preclude motivational differences in other areas of life (cf. Pothos & Kirk, 2004), including substance use. Regardless, given the finding of some differences in substance use, it becomes important to explore in a directed way possible sources for these differences.

In conclusion, the results provide some support for the idea that dyslexia leads to different patterns of substance use in the studied population. Our investigation allowed a consideration of several possibilities for further work, in this exciting research direction.

References

Barrett, S. P., Darredeau, C., & Pihl, R. O. (2006). Patterns of simultaneous polysubstance use in drug using university students. *Human Psychopharmacology: Clinical and Experimental*, 21(4), 255-263.

Becker, J. B., & Hu, M. (2008). Sex differences in drug abuse. *Frontiers in neuroendocrinology*, *29*(1), 36-47.

Bewick, B. M., Mulhern, B., Barkham, M., Trusler, K., Hill, A. J., & Stiles, W. B. (2008). Changes in undergraduate student alcohol consumption as they progress through university. *BMC Public Health*, 8(1), 163.

Bishop, D. V. M. (2002). Cerebellar Abnormalities In Developmental Dyslexia: Cause, Correlate Or Consequence? *Cortex*, 38(4), 491-498.

Bradley, L., & Bryant, P. E. (1983). Categorizing sounds and learning to read-a causal connection. *Nature*, *301*, 419-421.

Casco, C., Tressoldi, P.E. And Dellantonio, A., (1998). Visual Selective Attention And Reading Efficiency Are Related In Children. *Cortex* 34, 531–546.

Cox, W. M., Fadardi, J. S., & Pothos, E. M. (2006). The Addiction-Stroop Test: Theoretical Considerations And Procedural Recommendations. *Psychological Bulletin,* 132, 443-476.

Cox, W. M., Pothos, E. M., Hosier, S. G. (2007) Cognitive-Motivational Predictors Of Excessive Drinkers' Success In Changing. *Psychopharmacology* 192, 499-510.

Critchley, M. And Critchley, E.A. (1978) *Dyslexia Defined.* Heinemann: London.

Dåderman, A. M., Meurling, A. W., & Levander, S. (2012). 'Speedy Action over Goal Orientation': Cognitive Impulsivity in Male Forensic Patients with Dyslexia. Dyslexia, 18(4), 226-235.

Eden, G. F., & Zeffiro, T. A. (1998). Neural systems affected in developmental dyslexia revealed by functional neuroimaging. *Neuron*, *21*(2), 279-282.

Ewing, J. A. (1984). Detecting Alcoholism - The Cage Questionnaire. *Jama-Journal Of The American Medical Association, 252*(14), 1905-1907.

Facoetti, A., Paganoni, P., Turatto, M., Marzola, V., & Mascetti, G. G. (2000). Visual-Spatial Attention In Developmental Dyslexia. *Cortex, 36*(1), 109-123.

Frederickson, N., & Jacobs, S. (2001). Controllability Attributions For Academic Performance And The Perceived Scholastic Competence, Global Self-Worth And Achievement Of Children With Dyslexia. *School Psychology International, 22*(4), 401-416.

Frith, U., Landerl, K., & Frith, C. (1995). Dyslexia and verbal fluency: More evidence for a phonological deficit. *DYSLEXIA-CHICHESTER-*, *1*, 2-11.

Grigorenko, E. L. (2006). Learning disabilities in juvenile offenders. *Child and Adolescent Psychiatric Clinics of North America*, *15*(2), 353-371.

Hammersley, R., Marsland, L., & Reid, M. (2003). *Substance Use By Young Offenders: The Impact Of The Normalisation Of Drug Use In The Early Years Of The 21st Century*. Home Office Research Study 261. London: Home Office Research And Statistics Directorate.

Jensen, J., Lindgren, M., Meurling, A. W., Ingvar, D. H., & Levander, S. (1999). Dyslexia among Swedish prison inmates in relation to neuropsychology and personality. *Journal of the International Neuropsychological Society*, *5*(05), 452-461.

Kirk, J., & Reid, G. (2001). An Examination Of The Relationship Between Dyslexia And Offending In Young People And The Implications For The Training System. *Dyslexia, 7*(2), 77-84.

Kirk, J., & Reid, G. (2001). An Examination Of The Relationship Between Dyslexia And Offending In Young People And The Implications For The Training System. *Dyslexia, 7*(2), 77-84.

Liberman, I. Y., Mann, V. A., Shankweiler, D., & Werfelman, M. (1982). Children's memory for recurring linguistic and nonlinguistic material in relation to reading ability. Cortex, 18(3), 367-375.

MacDonald, S., (2009). Windows of reflection from Adults with Dyslexia: Conceptualising Dyslexia Using the Social Model of Disability. Dyslexia. An International Journal of Research and Practice, 15 (4). pp. 347-362.

MacDonald, S., (2012). Biographical pathways into criminality: understanding the relationship between dyslexia and educational disengagement. Disability & Society, 27 (3). pp. 427-440

Maehler, C., & Schuchardt, K. (2009). Working memory functioning in children with learning disabilities: does intelligence make a difference?. *Journal of Intellectual Disability Research*, *53*(1), 3-10.

Matson, S. C., & Haglund, K. A. (2000). Relationship between scholastic and health behaviors and reading level in adolescent females. *Clinical pediatrics*,*39*(5), 275-280.

Nicolson, R. I., & Fawcett, A. J. (1990). Automaticity: A new framework for dyslexia research?. *Cognition*, *35*(2), 159-182.

O'Brien, C. P. (2008). The CAGE Questionnaire For Detection Of Alcoholism. *JAMA: The Journal of the American Medical Association,* 300(17), 2054–2056.

Parrott, A. C., Sisk, E., & Turner, J. J. D. (2000). Psychobiological Problems In Heavy 'Ecstasy' (MDMA) Polydrug Users. *Drug And Alcohol Dependence, 60*(1), 105-110.

Pavlidis, G. T. (1991). Diagnostic Significance And Relationship Between Dyslexia And Erratic Eye Movements. In J. F. Stein (Ed.), *Vision And Visual Dyslexia* (Pp. 263-270). London: Macmillan.

Pothos, E. M., & Cox, W. M. (2002). Cognitive Bias For Alcohol-Related Information In Inferential Processes. *Drug And Alcohol Dependence,* 66(3), 235-241.

Ray, N. J., Fowler, S., & Stein, J. F. (2005). Yellow filters can improve magnocellular function: motion sensitivity, convergence, accommodation, and reading. *Annals of the New York Academy of Sciences*, *1039*(1), 283-293.

Roach, N. W., & Hogben, J. H. (2007). Impaired filtering of behaviourally irrelevant visual information in dyslexia. Brain, 130(3), 771-785.

Rodgers, J., Buchanan, T., Scholey, A. B., Heffernan, T. M., Ling, J., & Parrott, A. C. (2003). Patterns of drug use and the influence of gender on self-reports of memory ability in ecstasy users: a web-based study. Journal of Psychopharmacology, 17(4), 389-396.

Shaywitz, S. E. (1998). Current Concepts - Dyslexia. *New England Journal Of Medicine, 338*(5), 307-312.

Sparks, R., Patton, J., Ganschow, L., Humbach, N., & Javorsky, J. (2008). Early first-Language Reading And Spelling Skills Predict Later Second-Language Reading And Spelling Skills. *Journal Of Educational Psychology*, 100, 162–174.

Stacy, A. W. (1997). Memory Activation And Expectancy As Prospective Predictors Of Alcohol And Marijuana Use. *Journal Of Abnormal Psychology*, 106, 61-73.

Stanovich, K. E. (1988). Explaining the differences between the dyslexic and the garden-variety poor reader The phonological-core variable-difference model.*Journal of learning disabilities*, *21*(10), 590-604.

Stein, J. (1990). Unstable Binocular Control And Poor Visual Direction Sense In Developmental Dyslexics. In G. Hales (Ed.), *Meeting Points In Dyslexia*. Reading, England: British Dyslexia Association.

Steptoe, A., Wardle, J., Cui, W., Bellisle, F., Zotti, A. M., Baranyai, R., & Sanderman, R. (2002). Trends in smoking, diet, physical exercise, and attitudes toward health in European university students from 13 countries, 1990–2000. Preventive medicine, 35(2), 97-104.

Tallal, P. (1980). Auditory Temporal Perception, Phonics, And Reading Disabilities In Children. *Brain And Language, 9*(2), 182-198.

Tiffany, S. T. (1990). A Cognitive Model Of Drug Urges And Drug-Use Behavior: Role Of Automatic And Nonautomatic Processes. *Psychological Review*, 97, 147-168.

Vellutino, F. R., Fletcher, J. M., Snowling, M. J., & Scanlon, D. M. (2004). Specific reading disability (dyslexia): What have we learned in the past four decades?. *Journal of child psychology and psychiatry*, *45*(1), 2-40.

Vinegrad, M. (1994) A Revised Adult Dyslexia Checklist. *Educare No.* 48, Pp. 21-23, March 1994.

Webb, E., Ashton, C. H., Kelly, P., & Kamali, F. (1996). Alcohol and drug use in UK university students. The lancet, 348(9032), 922-925.

Yates, R. (2012). Bad mouthing, bad habits and bad, bad, boys: an exploration of the relationship between dyslexia and drug dependence. Mental health and substance use, 6(3), 184-202.