American Journal of Applied Psychology, 2015, Vol. 3, No. 4, 94-99
Available online at http://pubs.sciepub.com/ajap/3/4/3

DOI:10.12691/ajap-3-4-3

Comparing Educational Self-regulation Strategies and Cognitive Failures of Dysgraphic and Normal Students

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Abstract This study aimed at comparing educational self-regulation strategies and cognitive failures of dysgraphic and normal students. This study is a comparative one which is based on the case-witness methodology. All male students in Tehran between nine to twelve years of age with or without dysgraphia in the school year 2014-2015 were included this study. The participants were 30 students between nine to twelve years of age afflicted with dysgraphia who were selected through multistep cluster sampling and 30 normal male students who were selected based on cloning method (in terms of educational background, age, and socio-economic status). In order to collect the data, self-regulation in learning and cognitive failure questionnaires were used. The results of MANCOVA showed a statistically significant difference between the two groups with regard to their cognitive failures and self-regulatory learning ($P<0.01$). We conclude that students suffering from dysgraphia have higher levels of distraction and memory problems which are usually ignored at school. Also, self-regulatory management plays a crucial role in the educational success of children, adolescents, and adults.

Keywords: *cognitive failure, dysgraphia, self-regulatory learning*

Cite This Article: Mojtaba Ashouri, Nasrollah Veysi, Niloufar Azadikhah, Homa Sheykhlar, and Nasram Shayan, "Comparing Educational Self-regulation Strategies and Cognitive Failures of Dysgraphic and Normal Students." *American Journal of Applied Psychology*, vol. 3, no. 4 (2015): 94-99. doi: 10.12691/ajap-3-4-3.

1. Introduction

Writing is a complex neural process which needs synchronization of brain's multiple mechanisms. Writing requires the stimulation and combination of multiple information resources, memory, attention, language, motor skills, and cognition. Dysgraphia is a specific learning disability that affects the acquisition of written language and use of written language for expressing thought. Dysgraphia is a condition in which writing alphabets by hands is damaged in such a way that problems are caused in handwriting and, sometimes, spelling [23]. Students afflicted with dysgraphia have also problems in the following fields: accuracy and correctness of the alphabets and written vocabularies, matching and synchronizing spelling, appropriate ordering and organization in writing, calligraphy and writing coherence ([22]; as quoted by [3]). On the other hand, writing is a really challenging process in many people, especially students afflicted with dysgraphia; even skillful writers sometimes face difficulty designing, revising, and evaluating their writings. It is, therefore, not surprising that many of the students have problems with writing; for example, recent studies have led to the result that out of 5 elementary students, only one of them acquires the knowledge and skills necessary for writing [21]. The prevalence of dysgraphia is not clear but, like dyslexia, it is reported to be 4% of the school-aged children (DSM-IV, 2007; translated by Rezaie, 2009). As the results of studies show, students with learning disabilities have significantly higher levels of cognitive failures in comparison with normal students [4].

One of the variables which can impact the educational performance of the students afflicted with dysgraphia is cognitive failure. Cognitive failures are the errors one makes while doing the assignments he is actually fit for performing. As such, cognitive failure is a multidimensional structure which incorporates lapses in framing objectives, slips in actuating Schemes and blunders in activating activities. Most of the analysts concur on this issue that cognitive failures incorporate diversion, issues connected with memory, unintentional mistakes and failure in reviewing the names. More noteworthy frequencies of cognitive failures have been accounted for in women than in men. The scores of cognitive failures increment fundamentally as one becomes more seasoned. Rousselle & Noel concluded that students with learning disabilities are essentially weaker than normal students in memory capacities, for example, active memory, names memory, faces memory, visual-spatial active memory, and long-term memory. Geary indicated in a different exploration that students with cognitive failures have more issues gaining and reviewing

ideas, challenges in counts, memory issues, visual-spatial handling failures, metacognition failures (arranging, observation and requesting) and use youthful critical thinking methods. Bagian Kooleh Marz et al [4] acknowledged in their study that students with taking in disabilities experience the ill effects of more elevated amounts of cognitive failures and negative feelings than normal students.

Another variable which is presumably watched less habitually in children and youths beset with learning disorders is obtaining of education self-regulation. Bandura believes that self-regulation is the use of self-guiding, self-control and autonomous capacities and abilities. As indicated by his view, the aforementioned capacities vary affected by individuals' accepts about self-efficacy on their different activities and practices. Self-regulation is characterized as mental efforts made to control internal status, systems and Functions to achieve more noteworthy Goals. The results show that students with and without learning disabilities have critical contrasts as far as instructive self-regulation is concernned [31]. Lackaye & Margalit [25] and Baird, Scott, Dearin& Hamill [12] indicated in their study that students with learning disabilities report lower levels of social and instructive self effectiveness. The results likewise demonstrated lower levels of instructive self-regulation and more noteworthy propensity to cigarette and dreugs among students with instructive issue [21,28,29]. Klassen [10] additionally demonstrated that normal students have larger levels of instructive self-regulation learning than students afflicted with learning disabilities; and lower levels of social and emotional aptitudes in these students are connected with lower levels of instructive self-regulation. Swanson, Zinozeng and Jerman found in their study that those children who experience issues in psychological procedures, consideration and translating have more issues in assignments connected with active memory and reviewing the verbal cases. Costner &Losier (as cited by [5]) found that self-regulation has a positive association with different pointers of instructive improvement and instructive translation, while the disguised regulation is connected with the unsafe markers. These outcomes demonstrate that the relative advantages of interior inspiration in advancement of positive consistence in the field of instruction are not exactly the self-regulation.

The results have demonstrated that students with learning issue (dyslexia and dysgraphia) have certain mental attributes which recognize them from others, some of which are: a negative demeanor towards themselves as well as other people, no reaction to others in social communications, improper self-revelation designs, inactivity in learning system, critical thinking wastefulness, learnt weakness, lack of ability in using metacognitive methods . We can likewise say that these children experience the ill effects of lacks in understanding interpersonal contentions, critical thinking aptitudes, memory, data preparing, paying consideration on the title of the essential and entangled side and the social ability in interpersonal connections, hence being in a lower level than typical children. Then again, mental attributes, behavioral issues, mode states (despondency and tension), encountering negative feelings and simultaneousness of other mental handicaps of youth period with dysgraphia, high predominance of this issue in students and the part of self-administrative methodologies and insight as key components of accomplishment, wellbeing advancement and decrease of mental issues of such students and the examination crevices in this field and usage of the aftereffects of this exploration in pathology of those distressed with dysgraphia are critical necessities of this study. In this way, the present's objective examination is a correlation of instructive self-administrative methodologies and subjective disappointments in students afflicted with dysgraphia and ordinary students.

2. Research Hypotheses

Students afflicted with dysgraphia have lower level of self-regulation ability than normal students.

Students afflicted with dysgraphia have higher level of cognitive disorder than normal students

3. Methodology

Research plan: concerning the nature of this subject and the objectives of research, the present study can be considered as a casual-comparative (post incidental) research.

Sample population and sampling method: the study population of this research included the male third to sixth grade elementary school students of Tehran in academic year 2014-15. In order to sample and select subjects, multistep cluster random sampling method wass utilized. Out of the 19 educational zones, the third zone was selected and within that zone, 5 male schools were selected randomly to study third, fourth, fifth and sixth grade students. Based on teachers' ideas and signs of dysgraphia, 30 students suspected of dysgraphia were selected. After administering the diagonal tests (Veksler's test of kids' intelligence [2] validated by SimaShahim in Shiraz University and Dysgraphia test validated by Fallah Chay [1]), 30 students with dysgraphia disorder were selected based upon the exit and entrance criteria. 30 normal students were also peered with the group afflicted with dysgraphia based on the age and educational level. Through application based upon the reports recorded in the student's file (Veksler's intelligence test, diagonal tests and teachers' reports) and the interview structured based upon DSM-IV-TR, the entrance and exit criteria of the subjects' homogeneity were observed: A- entrance criteria including diagnosis of disability in writing, aging 9 to 12; having average IQ in Veksler's intelligence test for children [2] and absence of neurological and sensory disabilities; B- exit criteria including severe concurrent disorders such as hyperactivity/attention defect disorder, oppositional defiance disorder (ODD) and depression and having an IQ less than 85 in Veksler's intelligence test. The following tools were used in the present research.

Structured clinical interview: in order to study the validity and confirm the diagnosis recorded in the file of each student afflicted with dysgraphia, the clinical interview structured based upon DSM-IV-TR was administered on all students.

3.1. Fallah Chay's Dysgraphia Test

This test was used in order to measure the efficacy of dygraphic subjects. The reliability and ability of this test in Tarbiat Modarres University was calculated by Fallah Chay [1]. The validation of these tests was 0.95 and the reliability was 0.91. In order to make dictation exam, first four levels of difficulty were considered.

1. The first level or the easiest level which consisted of visual words whose frequency was 15 or more.
2. The second level which included words with the frequency of 10 to 14.
3. The third level which included words whose frequency was between 5 to 9.
4. The fourth level or the most difficult level which included words whose frequency was between 1 to 4.

Each level consist of 15 to 20 words. Therefore the dictation exam of the first and the second years had 60 words, and the dictation exam of the third, fourth, and the fifth year included 80 words. The difficulty is taken into account when giving the exams of each level. The highest level is the one in which a student writes 90 to 100 % of the words correctly. The educational level is achieved when a student writes 75 to 89% of the words correctly. This level is considered as the writing level of the student. When the number of mistakes a student makes is more than 25% of the words, the exam is stopped and a lower level which easier is used and this will continue until the educational level is achieved.

Educational self-regulation scale: this questionnaire was prepared by Rian and Cannel in 1989. It includes 32 questions and 4 components of external regulation, internalized regulation, cognitive regulation and internal stimulation. Each question is scored based upon the Likert's four-degree scale (1 to 4) and the scores range from 32 to 128. The validity of the questionnaire is calculated based upon the internal consistency coefficient and the coefficients of Cronbach's alpha for micro-scales range from 0.69 to 0.75. In another research, the consistency coefficient for the micro-scales ranged from 0.62 to 0.82. Rian and Cannel studied the internal consistency coefficient of this questionnaire in three urban, rural and sub-urban samples and Cronbach's alpha coefficients for the micro-scales were reported to range from 0.62 to 0.82. Salarifar, Pour Etemad, Heydari and Asghar Nejad calculated the validity of this questionnaire based upon internal consistency coefficient where Cronbach's alpha for the micro-scales was reported to range from 0.73 to 0.79 and the total validity of the scale was also 0.89.

Cognitive failure questionnaire (CFQ): this scale was prepared by Broadbent, Copper. Fitz Gerald and Parkz in 1982. This questionnaire includes 24 articles and the subjects answer these articles in the form of a 5-degree scale (from "never" to "always"). The 24 articles of this questionnaire were distributed among 4 micro-scales including distraction (9 articles), problems associated with memory (7 articles), inadvertent mistakes (7 articles) and inability to remember names (2 articles). Mecacci&Righi reported a Conbach's alpha coefficient of 0.84 for the whole scale. Vallas reported 0.96 and 0.51 for Cronbach's alpha coefficient and the validity coefficient of this questionnaire respectively. In an introductory study intended to validate the cognitive failure questionnaire, Abolghasemi administered this test on 100 people and reported the internal consistency coefficient and retest reliability coefficient of it (one month later) around 0.89 and 0.77 respectively. The correlational coefficient of this test with the metacognition questionnaire was 0.45 and with Nilson's religious behavior scale was 0.21. In another research, Abolghasemi and Kiamarsi reported a Cronbach's alpha coefficient of 0.84 for the total scale, while this value was reported to be 0.79, 0.64, 0.66, and 0.62 for the micro-scales respectively.

3.2. Data Collection Methodology

Having made the arrangements and obtained the required permissions, we went to Tehran's center of learning disabilities and obtained the list of all students of that center by considering the disorder. After sampling and in order to confirm the diagnosed problem, the files of all members of the sample (the results of diagonal tests, intelligence test, teachers' reports, etc) were investigated and all members of the sample were subjected to clinical interview based on DSM-IV-TR criteria for learning disabilities. Finally, some people were removed from the research and replaced by other samples. After identifying students afflicted with dysgraphia, the goal of the research was explained to them and questionnaires were distributed among them. They were asked to read the questions carefully and choose the answers based upon their features and leave no questions unanswered. The information was gathered in forms of groups from the selected schools. Finally, the collected data were subjected to statistical analysis through multivariable variance analysis (MANCOVA). Assuring people about the secrecy of their information and freedom of choice for participation in the research were among the moral points the researchers were bound with.

4. Results

Table 1. the mean and standard deviation of educational self-regulatory components and cognitive failure in students with and without dysgraphia

variable	dysgraphia		Normal	
	M	SD	M	SD
external regulation	14.12	2.23	18.45	3.05
internalized regulation	17.23	3.02	14.45	2.15
cognitive regulation	15.34	2.46	18.26	3.89
internal stimulation	14.12	2.22	17.23	2.78
total educational self-regulation	60.81	6.26	68.39	7.12
distraction	25.36	2.46	21.56	2.45
problems associated with memory	22.14	2.23	17.52	1.89
inadvertent mistakes	21.15	3.01	16.54	2.16
not remembering the names	5.36	1.1	3.55	1
total cognitive failure	74.01	5.15	59.17	6.41

As we see in Table 1, the mean (and standard deviation) in students afflicted with dysgraphia is 60.81 (3.31) for total educational self regulation and 74.01 (5.15) for cognitive failure. The mean (and standard deviation) in normal students is 68.39 (7.12) for educational self regulation and 59.17 (6.41) for cognitive failure (Table 1).

Table 2. the results of the significance test of multivariable variance analysis (MANCOVA) on the scores of educational self-regulation and cognitive failure in students with and without dysgraphia

status	test	value	DF of error	DF of hypothesis	F	P	Eta square
	Bartlet's Pillai	0.546	51	8	15.263	P0.001	0.546
	Wikl's lambda	0.213	51	8	15.263	P0.001	0.546
	Hetling effect	32.245	51	8	15.263	P0.001	0.546
	root on	32.245	51	8	15.263	P0.001	0.546

As it is seen in Table 2, the influence of group on the linear combination of dependant variables is significant (P0.001, F =15.263 and Wikle's Lambda =0.213). In other words, there is a significant difference between students with and without dysgraphia disorder in at least one dependant variable. Prior to using multivariable variance analysis parametric test, Box and Levin tests were utilized to observe its suppositions and the condition of homogeneity of variance/covariance matrices was fulfilled (P=0.075, F=2.163, BOX=6.356). Based on Levin's test and lack of her significance for all variables, the condition of equality of variances of the groups studied is fulfilled.

Table 3. the results of Levene's test for equality of the group's variances

Levene's	DF1	DF2	F	P
external regulation	1	58	1.326	0.113
internalized regulation	1	58	0.958	0.312
cognitive regulation	1	58	0.683	0.419
internal stimulation	1	58	0.885	0.372
distraction	1	58	0.754	0.399
problems associated with memory	1	58	0.315	0.589
inadvertent mistakes	1	58	1.365	0.103
not remembering the names	1	58	1.712	0.99

Table 4. the results of multivariable variance analysis on the mean of self-regulation and cognitive failure

variable	sum of squares	df	mean of squares	F	P	ES
external regulation	223.236	1	223.236	72.214	P<0.001	0.472
internalized regulation	114.745	1	114.745	55.321	P<0.001	0.356
cognitive regulation	196.789	1	196.789	66.645	P<0.001	0.399
internal stimulation	125.876	1	125.876	62.417	P<0.001	0.335
educational self-regulation	456.854	1	456.854	0.456	P<0.001	0.512
distraction	203.148	1	203.148	70.349	P<0.001	0.456
problems associated with memory	227.854	1	227.854	78.471	P<0.001	0.519
inadvertent mistakes	212.365	1	212.365	66.198	P<0.001	0.398
not remembering the names	112.356	1	112.356	19.546	P<0.009	0.310
cognitive failure	495.845	1	495.845	163.365	P<0.001	0.547

Based on the results of MANOVA test, there is a significant difference between normal and dysgraphic students in terms of education self-regulation (P<0.001, F(57 and 1)=126.456), Also its subscales such as external regulation (F(57,1) = 72.214 , P<0.001)), projected regulation (F(57,1) = 55.321 , P<0.001)), recognized regulation (F(57,1) = 66.645, P<0.001)), internal motivation (F(57,1) = 62.417, P<0.001)) and cognitive failure (P<0.001, F(57 and 1)=163.365), also its subscales such as distraction (F(57,1) = 70.349, P<0.001)), and memory problems (F(57,1) = 78.471, P<0.009)), inadvertent errors (F(57,1) = 66.198, P<0.00)), and not remembering names (F(57,1) = 19.546, P<0.009)). Students afflicted with dysgraphia showed lower levels of educational self-regulation and higher levels of cognitive failures.

5. Conclusion and Discussion

The objective of this study was to compare the educational self-regulation and cognitive failure in normal and dysgraphic students. The results showed a significant difference between normal and dysgraphic students in terms of educational self-regulation. In other words, students afflicted with dysgraphia had lower levels of educational self-regulation than normal students. These findings are in line with [10,21,28,29,31]. In an attempt to describe these results, we can say that learning self-regulation is an important issue for human learning (Chen, 2002; as quoted by Omen chi, 2006). Successful students show structured self-regulatory learning strategies and stimulation patterns while doing their assignments (e.g. attempt for success, enjoying challenges of action, appropriate use of learning strategies, setting special goals and displaying a high level of the sense of self-efficiency). On the other hand, unsuccessful students make less effort in learning and have less desire to do the activities. They are incapable of setting special goals and learning strategies, have low levels of self-efficiency and rarely attain high levels of success. As a matter of fact, students afflicted with dysgraphia have low levels of learning self-regulation because they are incapable of adjusting performance and retaining their lesson goals. Zimmerman [24] believes only those students who are aware of existence of self-regulation strategies, use their capabilities to attain the goals specified in activity and monitor themselves in doing an assignment can benefit from self-regulatory strategies. These students use cognitive and metacognitive strategies for a longer time, have greater vigilance than others and their peers usually refer to them [8]. However, development of self-regulatory skills is influenced by cognitive factors such as metacognition science, awareness and work memory; motivation and emotional factors such as interest and value of job and behavioral factors such as time and

management's efforts (quoted by [10]) and these factors are weak in students with learning disabilities. As a matter of fact compared to their peers, students afflicted with learning disorders show some sort of unwillingness to educational activities [9], display low levels of self-monitoring and self-efficiency, and benefit from less metacognitive strategies. In fact, such students consider the assignments as some sort of threat and do not display the required perseverance and stubbornness. Generally, learning self-regulation makes one consider himself capable, self-efficient and independent; while students with learning disabilities have lower levels of learning self-regulation than normal students because they have less self-efficiency and self-value.

The results also indicated a significant difference between normal and dysgraphic students in terms of cognitive failure. In other words, students afflicted with dysgraphia suffered from higher levels of cognitive failure than their normal counterparts. These results are in line with the study conducted by [16]. In an attempt to describe these results, we can say that cognitive awareness covers our emotions and experiences and cognitive experience or cognition adjustment or control procedures are a group of cognitive procedures which guide one's thoughts in problems solving and decision making situations and result in better performance of memory [13]. Thus, cognitive awareness helps one have a higher speed of decision making. One's knowledge of cognitive strategies will bring him some sort of metacognition which is focused on metacognitive strategies. Thus, the individual who has greater knowledge about this component has a more complete surveillance while utilizing metacognitive strategies and chooses the most effective strategy based upon the nature of assignment. What's more, he keeps monitoring his performance and changes his strategies to attain his goal if necessary. Thus, one's knowledge of cognitive strategies is associated with the better performance of decision making for writing and cognitive processing suitable with the type of assignment [14].

In another attempt to describe the results of this study, we may say that cognition is defined as one's knowledge of what he knows and a range of executive functions such as attention, surveillance, control, planning, and error diagnosis. The information created by cognition is usually experienced in the form of mental emotions which can influence behavior. Someone with weak cognitive knowledge is not aware of what he knows and can not utilize executive functions. Thus, he will probably have more errors in educational procedures. On the other hand, since inability in writing lesson materials prevents correct information processing and results in errors (because it reduces cognitive abilities), this circle of incorrect processing of error will render individuals unable to write [16]. People with greater cognitive failures can not perform well in doing the assignments assigned to them because they are suffering from distraction and memory problems. This ill performance increases the level of their errors. As students afflicted with dysgraphia are not aware of their emotions and cognitions and can't use executive functions correctly, they will probably face errors and doubts and suspensions in social and educational situations more frequently. As a matter of fact, cognitive failure means one's inability in completing assignments which he is naturally capable of doing. Cognitive failure is associated with how one learns an important incident, short term memory's capacity, reduction of the consciousness level and distracted attention [18]. Various studies have yielded a positive and significant relationship between cognitive failure and performance in assignments [19]. Based on the results of this study, it seems those people who have more mental ruminations about the benefits of worrying, worries about controlling ability, and worries about their cognitive abilities and functions are more probable to display cognitive failure and, as a result, dysgraphia. The results also indicate that cognitive failures have a significant influence on educational performance and dysgraphia among students suffering from it

Finally, the small volume of the sample and the impossibility of comparing it against girls aging 9 to 12 afflicted with dysgraphia were the most important limitations of this study. We hope to be able to make this comparison in future researches. Supports of teachers and schools for those students with learning disabilities and teaching and self-regulation skills can play a major role in increasing the compliance and self-regulatory skills of such students and also by providing good conditions for development and teaching cognitive and metacognitive skills it can provide students with more learning opportunities.

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