International Journal on
"Technical and Physical Problems of Engineering"
(IJTPE)
Published by International Organization of IOTPE

ISSN 2077-3528
IJTPE Journal
www.iotpe.com
ijtpe@iotpe.com

June 2024 | Issue 59 | Volume 16 | Number 2 | Pages 142-150

TOWARDS ENGINEERING PEDAGOGICAL APPROACHES FOR ADDRESSING EDUCATIONAL FUNCTIONING DISORDERS

H. Baba B. Touri

Laboratory of Sciences and Technologies of Information and Education (LASTIE), Faculty of Sciences Ben M'Sick, Hassan II University, Casablanca, Morocco, babahind46@gmail.com touribouzekri@gmail.com

Abstract- The increase in symptoms linked to educational functioning disorders has become a major recent public problem, but despite efforts, some children only benefit from specific monitoring later. In this study, Moroccan children suffering from these disorders were revealed through specific tests to identify each type of disturbance. The fundamental goal of this study was to determine the influence of age in the increase in acute signs in children with educational functioning disorders using quantitative methods, based on a non-correlational research design experimental and to demonstrate the need to involve educational engineering in the management of different disorders of educational functioning in children. Furthermore, the following variables are considered: Age, disorders and success rate are the variables examined in this study involving a sample of 621 students from three schools under the Bouskoura provincial government. Participants were invited to complete a questionnaire developed by professionals in speech interventions from the Study Group on the Disorders in Logical-Mathematical Activities of Logical-Mathematical Activities (GEPALM) and the group for research and promotion of research in speech intervention, Cogi'Act. The acquired results were analyzed utilizing IBM SPSS Statistics 21 software. The findings predict that the age of children with educational functioning disorders and different types of disorders is positively correlated, p = 0.001, and of high intensity: 93.3% of all correlations. Furthermore, age was significantly correlated with the percentage of academic success in children identified with reasoning deficits, with r = -0.933, strong and negative intensity, as a function of time and symptoms appearing with each type of disorder. Finally, interventions in the educational management of disorders in the school environment are obvious to better minimize the severe consequences of these disturbances for sick children and to improve their academic performance.

Keywords: Age, Management, Educational Functioning Disorders, Success Rate, Educational Children.

1. INTRODUCTION

In the school environment, children with educational functioning disorders face complications in their studies, which are reflected in their academic skills with poor results. These difficulties particularly intensify with age. These deficits can take various forms, such as attention deficit hyperactivity disorder (ADHD), disruptions in working memory, impairments in long-term memory, gaps in understanding theory of mind, deficits in visuospatial relationships, difficulties in grasping and applying analogies, consequences of brain damage on decision-making and alterations in educational functioning. These educational functioning disorders have been revealed in children by professionals specializing in this sector, using rigorous and precise tests for each type of disorder. In this article, we explore the abnormal signs associated with each of these educational functioning disorders linked to the challenges of managing these different types of educational functioning disorders within the class while following educational engineering dedicated to taking into account these disruptions in the educational process to increase their academic success

1.1. Long-Term Effects of ADHD

Individuals in their childhood and adolescence with ADHD experience difficulties in various areas related to task performance and verbal memory compared to peers of the same age and gender. Studies have confirmed the presence of functional and emotional process deficits in these children, whether during an in-depth evaluation of managerial practices or in research contexts. Our results also support the idea that children with ADHD have deficits in their functional and executive development, although their developmental trajectories parallel those of an age-matched control group without ADHD. It has frequently been observed that people with untreated ADHD display lower levels of self-esteem and social skills than their counterparts without ADHD [1, 2].

1.2. Long-Term Effects of Working Memory Disruptions

A more limited working memory capacity is indicative of less satisfactory performance in mathematics, reading, and science among children. In the school setting, the

Registered: 230920 Article Info: 1790 Accepted: 240526
Reserved: 240118 Available: 240630

workload of working memory may be felt more overwhelmingly for some individuals than for others, and children with memory difficulties may be interpreted as being reluctant to listen or follow instructions [3].

1.3. Long-Term Effects of Long-Term Memory Alterations

Storage and recall processes undergo no alteration, but issues at the encoding level led to noticeable deficits in long-term memory capacities in adults [4]. According to the work of Cutting and colleagues [5], concerning workplace performance assessments, children with disorders showed gaps in delayed recall and recognition tests, with no significant difference in forgetfulness rates.

1.4. Long-Term Effects of Theory of Mind Understanding Gaps

Alterations in Theory of Mind (TOM) have a specific impact on language skills. Individuals with TOM problems experience difficulties only in linguistic tasks that require taking into account the perspective and knowledge state of others. Meanwhile, their purely syntactic skills remain unchanged [6].

1.5. Long-Term Effects of Visuospatial Relationship Deficits

A frequently reported clinical observation in children with visuospatial relational deficits is their challenges lie in accurately evaluating their spatial distance from peers and grappling with obstacles with ascertaining the spatial arrangement of objects. These children encounter problems to an extent that impacts their academic performance, especially in mathematics. Creating a distinct diagnostic category for kids whose deficits in interpersonal abilities are predominant becomes necessary, as it contributes to difficulties in social interactions and leads to impairment in daily life activities. It should be noted that these children continue to face challenges in other areas of abilities, especially in terms of executive functions [7].

1.6. Long-Term Effects of Difficulty Grasping and Applying Analogies

Practitioners specializing in the educational field focus on the analysis of analogical representation errors associated with the place of generation. (by the learner or instructor) and the analogical procedure (choosing or mapping) as sources of misconceptions. Young children and beginners (in relation to specialized information) seem to be more prone to encountering challenges in choosing and mapping, which may also make them more vulnerable to unintended adverse effects. An educational analogy created to enhance the accomplishment of a particular learning goal may lead to unintended "negative outcomes" for these particular types of learners that subsequently hinder acquiring knowledge or ability to solve problems [8].

1.7. Long-term Effects of Brain Injury on Decision Making

Although all structures of the brain play an essential role in the overall decision-making process, each region contributes distinctly to the overall process. We propose that certain brain areas distinctly contribute to the processing and use of emotional information such as "attraction" and "fear" to guide advantageous decisions. The results indicate that individuals with alterations in these brain regions have difficulty evaluating choices in situations of uncertainty and avoiding negative emotional states. These difficulties distinguish them from the problems encountered by other patients with alterations in these specific areas. Various brain imaging research has revealed that privileged activation occurs during decision-making involving uncertainty, where the optimal response is not immediately apparent [9].

1.8. Long-Term Effects of Changes in Moral Educational Functioning

Women with PTSD resulting from childhood trauma exhibit notable changes in their Moral Educational Functioning, characterized by reduced utilitarian judgment and decreased altruism. It is clear that childhood trauma persists and continues to influence moral choices in adulthood [10]. Due to the lack of precise studies indicating the long-term effects of the educational functioning disorders mentioned previously [11] on children, as well as the symptoms associated with these different categories of disorders. Our objective was to determine the different possible correlations between educational functioning disorders and age on the one hand, and on the other hand, the correlations between age and the academic success rates of Moroccan children. Thus, through this study, we aim to associate the increase in acute signs of educational functioning disorders in children manifesting these disorders within the educational environment to the difficulties of managing these disturbances while introducing educational engineering, which takes into account the deficits in educational functioning.

2. MATERIALS AND METHODS

2.1. Participants

We carried out a research study involving 621 students, with the collaboration of the Nouaceur regional office, an entity affiliated with the Casablanca-Settat Academy, which facilitated the implementation of our experiment. In the three schools, we surveyed a random sample composed of 48.9% boys and 51.1% girls. Before collecting data, we consulted with teachers to assess their adherence to the objectives of our study. The experimental results were presented in a previous article.

2.2. Measuring Instruments

The Gepalm and Cogi'Act questionnaire, intended for language rehabilitation practitioners, aims to collect the opinions and responses of these professionals using these two specific tools in their practice.

It aims to collect information about their demographic data, their experience with Gepalm and Cogi'Act, satisfaction levels, challenges encountered and suggestions for improvement. The data collected from this questionnaire is crucial for the developers of Gepalm and Cogi'Act, because it helps them enrich their offerings and services to better meet the requirements of Rehabilitation Practitioners and their clients. Concerning learning outcomes, the success rate of students facing these difficulties is accessible on the "MASSAR" platform. This platform, approved by the Moroccan National Ministry of National Education, presents the prevalence rate of 8 types of educational functioning disorders.

2.3. Design

Quantitative methods used: The analysis of the relationships between age, educational functioning disorders and their correlation with academic success was carried out based on an experimental and correlational study. We simultaneously conducted tests for students of different ages and levels. However, we observe that the findings might pave the way for a new direction in socio-pedagogical thinking.

2.4. Analysis of Data

Pearson correlation analyzes were conducted to examine the relationships between eight disorders of educational functioning and fourteen disclosure tests specific to each of these types. The results are presented as correlation matrices, incorporating data such as the number of observations (N), the p-value (indicating the strength of the correlation), the Pearson correlation coefficient (r), and the square of this coefficient (r^2). To assess these relationships, partial correlations were used, taking into account control variables such as age, gender and disorder. The significance threshold was established at $p = 0.05$. The analysis was conducted utilizing IBM SPSS Statistics 21 software.

3. RESULTS

3.1. Relationship between Educational Functioning Disorders and Academic Performance

A correlation appears between the eight educational functioning disorders included in the Gepalm and Cogi'Act questionnaires and the average age associated with each type of educational functioning disorder. This correlation is adjusted for three variables: disorder, gender, and success rate. The eight disorders of educational functioning show very significant correlations with the average age of different types of disorders, characterized by high intensity ($r = 0.933$). Of the 288 correlations calculated, we observed that 152 relationships were positive, which is statistically highly significant ($p = 0.01$ to 0.996), depicting 52.7% of every connection. It should be noted that the correlations between educational functioning disorders and the average age of students are very significant ($p = 0.001$). The control effect on age-related correlations can elucidate these associations taking into account the variables of disorder, gender, and success rate.

Table 1. Correlations between age controlled by gender, disorder, and success rate in school

Age			Control Effect on Age			
Male age	Female Age	Average Age	Gender M	Gender F	Disorder	Success Rate
14.50	13.80	14.15	77.5%	22.5%	ADHD	68%
15.89	15.51	15.70	53.4%	46.6%	Working Memory Impairments	40%
15.20	14.71	14.95	43%	57%	Long-Term Memory Loss	33%
12.75	12.63	12.69	61 %	39%	Theory of Mind Deficits	30%
12.60	12.20	12.40	53.4%	46.6%	Visuospatial Relational Deficits	66%
13.42	13.25	13.33	------	-----	Challenges in Understanding and Applying Analogies	50%
11.98	11.82	11.90	88.1%	11.9%	The Effects of Brain Damage on Decision Making	45.2%
14.78	14.53	14.65	74%	26%	Disruptions of moral reasoning	30%

3.2. Correlation between Age, Gender, and Disorder

In this part, we will address the relationship between age and gender as well as their impact on the increase in the consequences of educational functioning disorders.

Table 2. Pearson correlations between three variables: age, gender, and educational functioning disorder

		Age	Gender	Disorder
Age	Pearson Correlation	1	0.388	0.933**
	Sig. (two-tailed)		0.342	0.001
	N	105	105	105
Gender	Pearson Correlation	0.388	1	0.247
	Sig. (two-tailed)	0.342		0.555
	N	105	105	105
Disorder	Pearson Correlation	0.933**	0.247	1
	Sig. (two-tailed)	0.001	0.555	
	N	105	105	105
** The correlation is significant at the 0.01 level (two-tailed).				

3.2.1. Correlation Analysis between Age and Gender

Our objective was to ensure the presence of such an association between age and gender through Pearson correlation. Age and gender have a weak positive correlation, with a correlation coefficient of 0.388. While the p-value significance is 0.342, exceeding 5%. Thus, this correlation is not statistically significant. This validates the absence of a correlation between age and gender in the population, suggesting that the age variable no longer has an effect on the gender variable.

3.2.2. Correlation Analysis between Gender and Disorder

We sought a relationship between two variables, gender and disorder, for which we employed Pearson correlation. The correlation coefficient between gender and disorder was 0.247, indicating a weak positive linear correlation between these two quantitative variables. While the significance value is $p = 0.555 > 0.05$, supporting that this correlation is statistically non-significant. This validates the lack of a link between the two variables, gender and disorder, in the population. This explains that gender does not affect the disorder.

3.2.3. Correlation Analysis between Age and Disorder

The age and disorder variables are scaling variables, and we have already verified that they are normally distributed and have a linear relationship, hence the emphasis on Pearson correlation. We want to know if there is such a relationship between age and the disorder. The correlation between age and disorder is strongly positive, with a correlation coefficient of 0.933. The p-value is less than 5%, with a value of 0.001. This correlation is statistically significant, certifying the presence of a link between the two variables, age and the disorder in the population. This means that as the age of children diagnosed with educational functioning disorders increases, the manifestations accompanying the disorder and its severity also increase (Table 2).

Table 3. Pearson correlations between three variables: age, percentage of male gender, and percentage of female gender

		Age	Percentage of gender male	Percentage of gender female
Age	Pearson Correlation	1	-0.137	-0.508
	Sig. (two-tailed)		0.746	0.198
	N	105	105	105
Percentage of gender male	Pearson Correlation	-0.137	1	0.106
	Sig. (two-tailed)	0.746		0.802
	N	105	105	105
Percentage of gender female	Pearson Correlation	-0.508	0.106	1
	Sig. (two-tailed)	0.198	0.802	
	N	105	105	105

3.3. Correlation between age, Percentage Male and Percentage Female

In this segment, we will focus on identifying the links that exist between age and the percentage of children with disruptions in the educational functioning of the male gender as well as that of the female gender.

3.3.1. Correlation Analysis between Age and Percentage of Male Gender

We chose to work with the Pearson correlation. We want to understand the link between these two variables: age and percentage of male sex.

The correlation coefficient between age and percentage of males is -0.137, indicating a weak negative linear correlation between these two quantitative variables. While the *p*-value, or significance value, is 0.746, which is greater than 0.05, which indicates that this correlation is statistically insignificant. This confirms the absence of such a link between these variables in the population. It confirms that age does not influence the percentage of men with educational functioning disorders.

3.3.2. Correlation Analysis between Age and Percentage of Female Gender

We are looking for a relationship between these two variables: age and percentage of female sex. We use the Pearson correlation since we have ensured the normal distribution of these two variables and that they have a linear relationship.

The correlation coefficient between age and the percentage of female sex is -0.508, explaining a moderate negative linear correlation between these two quantitative variables. While the significance value is $p = 0.198 > 0.05$, which shows that this correlation is statistically insignificant. This validates the non-existence of a link between the two variables: age and the percentage of females in the population. This means that age does not affect the percentage of women with educational functioning disorders.

3.3.3. Correlation Analysis between Percentage of Male Gender and Percentage of Female Gender

After confirming the normality of the distribution of these two variables and verifying their linear relationship, we established the Pearson correlation. We want to determine the connection between the percentage of male gender and the percentage of female gender.

The correlation coefficient between the percentage of male gender and the percentage of female gender is 0.106, indicating a weak positive correlation between these two quantitative variables. While the significance value is $p = 0.802 > 5\%$, so this correlation is statistically non-significant. This confirms the lack of a relationship between these two variables in the population. This signifies that the percentage of the male gender does not impact the percentage of the female gender. Table 3

3.4. Correlation between Age, Gender, and School Success Rate

In this section, we will analyze the existing correlation between age, gender and their impact on the academic success rate.

Table 4. Pearson correlations between three variables: age, tests for educational functioning disorders, and success rate

		Age	Success rate	Educational functioning disorder tests
Age	Pearson Correlation	1	-0.933**	0.933**
	Sig. (two-tailed)		0.001	0.001
	N	105	105	105
Success rate	Pearson Correlation	-0.933**	1	-1.000**
	Sig. (two-tailed)	0.001		0.000
	N	105	105	105
Educational functioning disorder tests	Pearson Correlation	0.933**	-1.000**	1
	Sig. (two-tailed)	0.001	.000	
	N	105	105	105
** The correlation is significant at the 0.01 level (two-tailed).				

3.4.1. Correlation Analysis between Age and Success Rate

We conducted research on the connection between these two variables: age and the success rate. We ensured the normality of the distribution of these two variables and they have a linear relationship, from which we use Pearson correlation. The correlation coefficient between age and success rate is 0.933, indicating a strong negative linear correlation between these two quantitative variables.

While The p-value of 0.001 is less than 0.05, indicating that this correlation is statistically significant. This confirms the existence of such a link between the two variables: age and success rate in the population. It shows that age influences the success rate, as when the age of children with disorders are increasing, the success rate decreases inversely.

3.4.2. Correlation Analysis between Educational Functioning Disorder Tests and Success Rate

After verifying the normal distribution of the two variables, we relied on Pearson correlation. We wanted to know if there was such an association between educational functioning disorder tests and the success rate. The relationship between tests for educational functioning disorders and the success rate is very strongly negative, with a correlation coefficient of -1. The p-value is < 5%, reaching 0.000. Also, this correlation is significant. However, this justifies that there is a strongly negative correlation between educational functioning disorder tests and the success rate. It reveals that the more tests to identify educational functioning disorders increase, the more the success rate in the study population decreases.

3.4.3. Correlation Analysis between Age and Educational Functioning Disorder Tests

Our goal is to determine if these two variables, namely age and educational functioning disorder tests, are related. The normality check of the distribution of these two variables has already been done, and it has been found that they have a linear relationship. We then chose Pearson correlation. The correlation coefficient between age and educational functioning disorder tests is -0.933, indicating a strong positive linear correlation between these two quantitative variables. While the *p*-value is equal 0.001 < 0.05, confirming that this correlation is statistically significant. This supports the existence of such a connection between the two variables: age and educational functioning disorder tests in the population. This implies that age impacts educational functioning disorders, as the age of children with these educational functioning disorders increases, tests for identifying acute consequences accompanying these disorders are also simultaneously increasing. Table 4

3.5. Analysis of Graphs by Groups of Three Variables

3.5.1. Comparison by Age and Disorder

Children with a high to medium success rate ranging from 66%, 50%, and 45.2%, respectively, exhibit Visuospatial Relational Deficits, difficulties related to the understanding and application of analogies, and the effects of brain lesions on decision-making, all belonging to the middle age category of 12.40, 13.33, and 11.90 years, respectively. Conversely, children with disorders such as working memory disturbances, long-term memory loss, theory of mind deficits, and moral educational functioning disturbances show a low success rate sequentially ranging from 40%, 33%, and 30%, with average ages of 15.70, 14.95, 12.69, and 14.65 years, respectively.

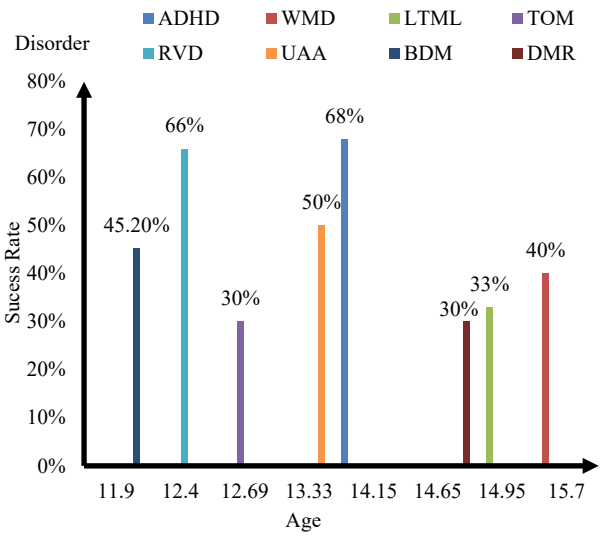

Figure 1. Success rate of children with disorders based on age

Exceptionally, children with ADHD achieve a success rate of 68%, and they are the only ones belonging to the middle age group with an average age of 14.15 years (Figure 1).

3.5.2. Comparison by Age and Gender

Only female children with a significant success rate of 68%, constituting 22.5% of the female gender, belong to the age group of 14.15 years. However, female students with a success rate ranging from 66%, 50%, and 45.2%, with corresponding female gender percentages of 46.6% and 11.90%, belong to the age group of 12.20, 13.25, and 11.90 years, respectively. On the other hand, female students with moderately low success rates ranging from 40%, 33%, to 30% have female gender percentages of 46.6%, 57%, 39%, and 26%, respectively, with ages of 15.51, 14.71, 12.63, and 14.53 years (Figure 2).

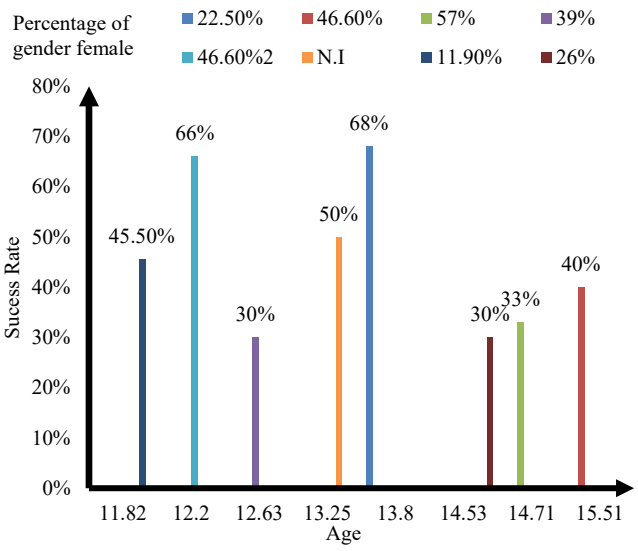

Figure 2. Success Rate Based on Female Gender and Age

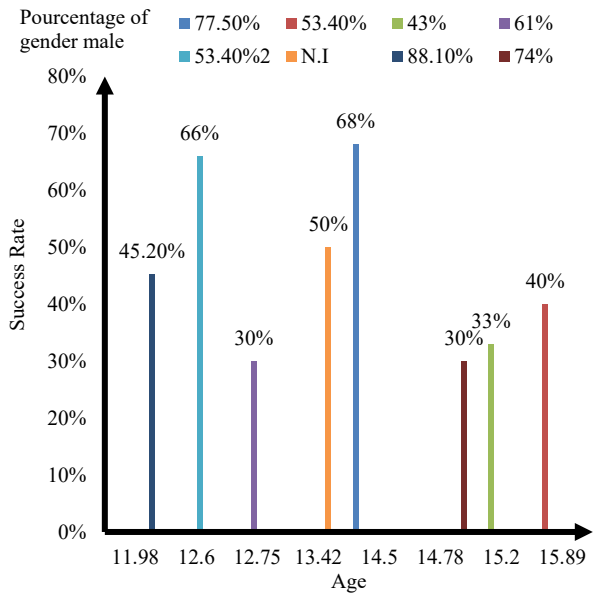

Figure 3. Success Rate Based on Male Gender and Age

A significant portion, 77.5%, of boys with a substantial success rate of 68% belong to the age group of 14.50 years. However, the proportion of male children with successive high to moderate success rates of 66%, 50%, and 45.2% is 53.4% and 88.10%, with their average age groups being 12.60, 13.42, and 11.98 years. On the other hand, male children with a relatively low success rate of 40%, 33%, and 30% have proportions of 53.4%, 43%, 61%, and 74%, with their subsequent ages being 15.89, 15.20, 12.75, and 14.78 years, respectively (Figure 3).

4. DISCUSSION

Our research initially aimed to identify different types of educational functioning disorders using specific tests. She also sought to establish a correlation between these disorders, the average age of onset of Moroccan students and their academic success rate. The main objective was to examine how age influences the learning of students detected with these disruptions over time, justifying their impact on academic achievement. We will delve into the primary findings in line with our research goal, exploring the correlation between the age group most affected by disorders of educational functioning disrupting the school career, types of disorders of educational functioning, the gender effect and their academic success rates. Our initial results revealed that all educational functioning disorders and age are strongly positively correlated. These correlations have a very significant and high intensity direct negative impact on the academic success of students. This implies that older children with these disorders have a detrimental effect on their low achievement rates. In other words, affected students with an earlier average age depending on their type of disorder statistically have a higher success rate than their older peers with these disorders.

These results were validated by Small [12] who states that with age, as the likelihood of memory loss rises, the mildest manifestation, known as age-associated memory impairment, is marked by an individual's subjective perception of memory decline. Standardized memory tests also reveal a reduction in objective memory performance when compared to older adults' youth. Interestingly, the present study by Duval et al [13] emphasizing a broad differentiation between subjective and objective Theory of Mind (ToM) evaluation, elderly participants exhibited inferior performance compared to younger individuals across all ToM assessments incorporated in the objective evaluation. They were less able to infer intellectual and emotional states than younger individuals and, in large part, more so than middle-aged adults.

Consequently, aging negatively impacts Theory of Mind when evaluated objectively. As shown in the research carried out by Libon et al [14], performance on visuospatial tests decreases with age, while performance on verbal tests remains fairly constant. According to Salthouse and Babcock [15], their studies found significant negative correlations between age and working memory measures, with coefficients ranging from -0.39 to -0.52. One suggested explanation is that many age-related disparities in working memory could be explained by a decrease in the speed of fundamental operations associated with age, which could directly impede children's academic performance students with age. The results completely confirmed the proposed hypotheses. In a socio-educational environment, parents are encouraged to guide children affected by these educational functioning disorders by promoting communication adapted to their emotional and personal needs within the home. The objective is to understand the repercussions of these deficits on their learning, which becomes more pronounced with age, and thus promote a healthy educational climate by adopting an educational approach adapted to their specific problems. At the same time, it is recommended to organize regular support sessions to assess their long-term well-being without neglecting other support approaches.

All these efforts are aimed at the interest of the learner and have a direct and significant influence on their academic success rate. Arnold et al. [16] highlighted that untreated individual with ADHD performed lower on achievement exams (79%) and scholastic attainment (75%) in comparison to controls without ADHD. ADHD negatively affects overall academic performance in the long term. Rothweiler and colleagues observed that the consequences of head damage appear to increase with age, regardless of the severity of the brain damage. This includes even the mildest injuries, which have an impact on the academic performance of the affected individuals [17,18]. In this regard, it seems that didactic teachers serve as mediators in educational action where the student is an active learner while better managing the educational class of students according to peer groups according to a differentiated pedagogy that facilitates their learning by taking into account account of their deficits. This can increase mutual cooperation as well as moral support among group members, thereby improving the self-confidence of these learners and, in the long run, improving academic achievement.

Furthermore, educational engineering plays a crucial role in managing educational functioning disorders in children in the classroom by adopting adaptive and personalized approaches. Initially, by identifying the specific needs of each student, educational engineers can design educational programs that take into account the different ways in which children learn. By integrating diverse teaching methods, such as the use of visual aids, practical activities, and interactive demonstrations, they provide students with various opportunities to assimilate concepts in a holistic manner. Moreover, the use of educational technologies can enable individualized learning, providing exercises tailored to the specific needs of each child, thereby enhancing cognitive skills and logical reasoning. Lastly, involving parents in this process as active partners helps maintain continuity between school and home, fostering a comprehensive support environment for children facing educational functioning disorders. By combining these approaches, educational engineering contributes to creating inclusive and effective educational environments for all students, promoting their intellectual development and academic success. The results indicate that the relationships between the integration of educational engineering and educational functioning disorders are negatively correlated in children with these deficits. These correlations have a highly significant and positive direct impact on the academic success of students, with a correlation coefficient of $r = 0.933$. Conversely, there is a negative correlation between the age of children with these deficits and the success rate in the absence of educational engineering for educational functioning disorders, with a correlation coefficient of $r = -0.933$.

In contrast, while no statistically significant distinction was noted between the control and treated groups, most studies found that teachers were able to implement engineering teaching units aimed at overcoming potential obstacles for students with intellectual disabilities, especially in learning scientific content. This was achieved using a quasi-experimental design group aimed at evaluating the influence of a universally designed curriculum in engineering. The results indicate that engineering education can support the cultivation of problem-solving abilities in students, addressing gaps in their prior knowledge despite limited receptive and expressive abilities. Additionally, it contributes to improving their communication skills, positively impacting their academic success. Nevertheless, a statistically significant difference was observed between the skills of students engaged in an engineering program and those who did not participate. Following their involvement in engineering units, an improvement in problem-solving skills ($p = .029$) <0.05 was noted [19]. Another study indicates a noteworthy, negative correlation among intellectual disorders and educational engineering.

However, the more educational engineering is designed by teachers following a 4E model (Engagement, Exploration, Engineering, Explanation) emphasizing research while utilizing technology and engineering to incorporate educational content in a focused and thoughtful approach, the more it contributes to enhancing the cognitive, affective, and behavioral engagement of students in classes. This also reduces the lack of engagement and gaps in problem-solving skills among children with intellectual deficits. The results indicate students with slight intellectual disabilities in the classrooms actively reacted, deeply engaging, while individuals with moderate intellectual disabilities sought additional support and performed well in lessons with teacher guidance [20].

Comparing these results, educational engineering applied to studies on educational functioning disorders offers notable advantages, including personalized learning, improved learner engagement, and continuous progress monitoring. These approaches allow for fine-tuned adaptation to individual needs, facilitate early identification of difficulties, and can make learning more accessible. However, these advantages are sometimes offset by drawbacks such as high financial and logistical costs, technology dependence leading to accessibility disparities, the need for technological skills among teachers, and challenges in universal adaptation. The success of educational engineering in the context of reasoning disorders depends on how these methodologies are applied and adjusted based on the specific needs of learners in each study.

In the end, the use of educational engineering to address educational functioning disorders has significant benefits but is accompanied by certain limitations. On the positive side, this approach offers increased personalization of learning, tailored to the specific needs of learners with educational functioning disorders. It proposes varied teaching methods, integrating visual aids, interactive activities, and educational technologies, thereby facilitating a deep understanding of concepts. The ability to continuously assess students' progress allows for the identification of gaps and adjustment of pedagogical approaches accordingly. However, educational engineering may also have disadvantages, such as high initial costs associated with designing customized programs for reasoning disorders. Moreover, excessive reliance on technologies can create accessibility obstacles and potentially cause distractions. Despite these challenges, a thoughtful implementation of educational engineering provides innovative solutions to enhance reasoning in learners with disorders, contributing to the creation of an inclusive and effective learning environment fostering their academic success.

5. CONCLUSIONS

Our study aimed to establish a correlation between diagnostic tests for educational functioning disorders with the age of students and their academic success rate in order to reduce the harmful consequences of these disorders and to promote pedagogy adapted to the age of these learners. Firstly, it was necessary to distribute a Gepalm and Cogi'Act questionnaire to communication specialists. in order to collect information on the different tests [21]. For educational functioning disorders used in Morocco. This study presents robust and very significant negative

correlations between the age of learners affected by educational functioning disorders and their academic results. As the age of learners with these disorders increases, the impact of these deficits on the likelihood of academic success decreases.

Children who achieve high success rates, specifically 66%, 50%, and 45.2%, demonstrate deficits in visuospatial relations, understanding and applying analogies, as well as the effects of brain injuries on decision-making. All these children belong to the middle age category, with respective average ages of 12.40, 13.33, and 11.90 years. On the other hand, children experiencing challenges such as working memory issues, long-term memory loss, theory of mind deficits, and difficulties in moral educational functioning exhibit lower success rates sequentially at 40%, 33%, and 30%. Their average ages are 15.70 years, 14.95 years, 12.69 years, and 14.65 years, respectively. Additionally, impaired educational functioning has been shown to have a positive correlation with age, with long-term effects increasing as age progresses. Implementing a multidisciplinary approach provides the opportunity for a comprehensive understanding of the complexity of intellectual challenges among learners.

It is undeniable that to optimize the effectiveness of the intervention of parents and educators, increased investments are necessary. Indeed, offering education adapted to the specific needs of children requires special training for teachers. This educational engineering aims to integrate learners into the social fabric, thus promoting the acquisition of the required skills [22]. The achieved results represent a notable advancement forward in the identification of new roles assigned to all actors in the Morocco's educational system, overseen by the Ministry of Education, including the role of the teacher towards better management improvement. classes of children showing deficits in educational functioning. This development is observed in light of the recent rise in the count of Moroccan children experiencing intellectual disorders. In conclusion, it is essential to consider, in future studies, the implementation of a rehabilitation practice with affected children, taking fully into account the social aspect to facilitate their integration. This is fundamental to solving the multidimensional problems faced by this category of children in their school curriculum.

REFERENCES

[1] E. Claesdotter, M. Cervin, S. Akerlund, et al., "The Effects of ADHD on Cognitive Performance", Nordic Journal of Psychiatry, Vol. 72, No. 3, pp. 158-163, 2017.

[2] V. Harpin, L. Mazzone, J.P. Raynaud, et al., "Long-Term Outcomes of ADHD", Journal of Attention Disorders, Vol. 20, No. 4, pp. 295-305, 2013.

[3] A. Forsberg, E. J. Adams, N. Cowan, "The Role of Working Memory in Long-Term Learning: Implications for Childhood Development", Psychology of Learning and Motivation, Vol. 74, pp. 1-45, 2021.

[4] T. Skodzik, H. Holling, A. Pedersen, "Long-Term Memory Performance in Adult ADHD: A Meta-Analysis", Journal of Attention Disorders, Vol. 21, No. 4, pp. 267-283, 2017.

[5] L.E. Cutting, C.W. Koth, E.M. Mahone, et al., "Evidence for Unexpected Weaknesses in Learning in Children with Attention-Deficit/Hyperactivity Disorder without Reading Disabilities", Journal of Learning Disabilities, Vol. 36, No. 3, pp. 257-267, 2003.

[6] N. Balaban, N. Friedmann, M. Ariel, "The Effect of Theory of Mind Impairment on Language: Referring After Right-Hemisphere Damage", Aphasiology, Vol. 30, No. 12, pp. 1424-1460, 2016.

[7] B.J. Forrest, "The Utility of Math Difficulties, Internalized Psychopathology, and Visual-Spatial Deficits to Identify Children with the Nonverbal Learning Disability Syndrome: Evidence for a Visual Spatial Disability", Child Neuropsychology: A Journal on Normal and Abnormal Development in Childhood and Adolescence, Vol. 10, No. 2, pp. 129-146, 2004.

[8] K.B. Zook, "Effects of Analogical Processes on Learning and Misrepresentation", Educational Psychology Review, Vol. 3, No. 1, pp. 41-72, 1991.

[9] J.A. Weller, I. P.Levin, B. Shiv, et al., "The Effects of Insula Damage on Decision-Making for Risky Gains and Losses", Social Neuroscience, Vol. 4, No. 4, pp. 347-358, 2009.

[10] A. Nazarov, V. Walaszczyk, P. Frewen, et al., "Moral Reasoning in Women with Posttraumatic Stress Disorder Related to Childhood Abuse", European Journal of Psych Traumatology, Vol. 7, No. 1, p. 31028, 2016.

[11] H. Baba, T. Bouzekri, A. Kasmi, et al., "Statistical Results of Reasoning Disorders in Children Worldwide", Journal of Hunan University Natural Sciences, Vol. 50, No. 2, 2023.

[12] G.W. Small, "What we Need to Know About Age Related Memory Loss", BMJ, Vol. 324, No. 7352, pp. 1502-1505, 2002.

[13] C. Duval, P. Piolino, A. Bejanin, et al., "Age Effects on Different Components of Theory of Mind", Consciousness and Cognition, Vol. 20, No. 3, pp. 627-642, 2011.

[14] D.J. Libon, G. Glosser, B.L. Malamut, et al., "Age, Executive Functions, and Visuospatial Functioning in Healthy Older Adults", Neuropsychology, Vol. 8, No. 1, pp. 38-43, 1994.

[15] P. Salame, A. Baddeley, "Disruption of Short-Term Memory by Unattended Speech: Implications for the Structure of Working Memory", Journal of Verbal Learning and Verbal Behavior, Vol. 21, No. 2, pp. 150-164, 1982.

[16] L.E. Arnold, P. Hodgkins, J. Kahle, et al., "Long-Term Outcomes of ADHD: Academic Achievement and Performance", Journal of Attention Disorders, Vol. 24, No. 1, pp. 73-85, 2020.

[17] B. Rothweiler, N.R. Temkin, S.S. Dikmen, "Aging Effect on Psychosocial Outcome in Traumatic Brain Injury", Archives of Physical Medicine and Rehabilitation, Vol. 79, No. 8, pp. 881-887, 1998.

[18] B. Pentland, P.A. Jones, C.W. Rov, et al., "Head Injury in the Elderly", Age Ageing, Vol. 15, pp. 193-202, 1986.

[19] B.A. Jimenez, G. Croft, J. Twine, et al., "Development of Engineering Habits of Mind for Students

with Intellectual Disability", The Journal of Special Education, Vol. 55, No. 3, pp. 174-185, 2021.
[20] W.W.M. So, "Engaging Students with Intellectual Disability in Science, Technology, Engineering, and Mathematics Learning", Science Education International, Vol. 3, No. 1, pp. 25-37, 2022.
[21] K. Slime, A. Maizate, O. Bouaissi, A. Hilmani, C. Mahmoudi, N. Mouine, "Intelligent System for Remote Diseases Diagnosis", International Journal on Technical and Physical Problems of Engineering (IJTPE), Issue 53, Vol. 14, No. 4, pp. 25-34, December 2022.
[22] K. El Arif, T. El Hassouni, B. El Wahbi, "Requirement of Higher Education Professions in Terms Of skills", International Journal on Technical and Physical Problems of Engineering (IJTPE), Issue 52, Vol. 14, No. 3, pp. 28-35, September 2022.

BIOGRAPHIES

Name: **Hind**
Surname: **Baba**
Birthday: 26.11.1994
Birthplace: Casablanca, Morocco
Bachelor: Human Biology and Physiology, Biology Laboratory, Faculty of Sciences Ben M'sik, Hassan II University, Casablanca, Morocco, 2016
Master: Engineering and Technology for Education and Training, LASTIE Laboratory, Faculty of Sciences Ben M'sik, Hassan II University, Casablanca, Morocco, 2019
Doctorate: Student, Department of Communication and Human Sciences, Faculty of Sciences Ben M'sick, Hassan II University, Casablanca, Morocco, Since 2019
Research Interests: Psychology, Pedagogy, Neuroscience
Scientific Publications: 5 Papers

Name: **Bouzekri**
Surname: **Touri**
Birthday: 19.05.1963
Birthplace: Casablanca, Morocco
Bachelor: English Studies, Department of English Studies, Faculty of Humanities and Social Sciences, Ibn Tofail University, Kenitra, Morocco, 1984
Master: Teaching of English as a Foreign Language, English Studies Department, Faculty of Humanities and Social Sciences, Ibn Tofail University, Kenitra, Morocco, 1986
Doctorate: Lecturing and Running Research in Educational Psychology, Behavioural Sciences and Communication Sciences and Disorders, Department of School Psychology, Faculty of Human Sciences, Mohammed V University, Rabat, Morocco / University of Texas at Austin, USA, 2008
The Last Scientific Position: Prof., Department of Communication and Human Sciences, Faculty of Sciences Ben M'sick, Hassan II University, Casablanca, Morocco, Since 2014
Research Interests: Behavioral Science, Psychology, Educational Psychology
Scientific Publications: 53 Papers, 10 Books, 4 Projects, 20 Theses
Scientific Memberships: LASTIE, EDGE Business School, Rotary Club Casablanca Nord Club