Cognitive Absorptionand its Relationship to some Frontal Lobe Executive Functions among Young People Who Use Smart Screen Devices:

A Descriptive Study at the University of Kasdi Merbah – Ouargla

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Abstract:

The following study aims to investigate the relationship between cognitive absorption and some frontal executive functions among young people who use smart screen devices. It is based on the descriptive approach, using a set of tools, namely: the cognitive absorption scale designed in the current study, the Hanoi test in the electronic version (application), linking paths test in the electronic version (application), and the visual working memory test modified by Dina Ali Samir.The sample consisted of 114 male and female students who were selected by the purposeful sampling method. Their ages range between 18-36 years, and they belong to three different faculties (Faculty of Hydrocarbons - Faculty of Mathematics and Material Sciences - Faculty of Economics and Management Sciences) at the University of Ouargla, Algeria (2020/2021).The study results show the following:

- The prevalence of cognitive absorption is high among young people who use smart screen devices.
- There is no statistically significant correlation between cognitive absorption and planning function among young people who use smart screen devices.
- There is no statistically significant correlation between cognitive absorption and cognitive flexibility among young people who use smart screen devices.
- There are no statistically significant differences in cognitive absorption according to the electronic medium, but there are statistically significant differences in the dimension of (sensing control) in favor of laptop computers and the dimension of (curiosity) in favor of smart phone devices.
- There is a statistically significant correlation between visual working memory and cognitive flexibility among young people who use smart screen devices.

The results of the study are interpreted based on the literary heritage of subject variables and previous studies.

Keywords: cognitive absorption, executive functions, young people, smart screen devices.

1- Problematic

With the advent of information technology, a new generation has emerged that is different from previous generations in terms of shaping its present and future.Several studies have sought to understand the needs of this generation and to direct its energy towards construction and reconstruction.One of the most prominent features of our generation is this extensive use of smart devices.The latter is a set of techniques and means that are employed to process the content that is intended to be communicated through the process of communication and interaction with others.It has become an important part and a necessary need in the daily life of young people, because of its great importance and positive impact in providing many services that contribute to upgrading the lifestyle of young people for the better. (Agarwal, R., 2000)

Most studies are concerned with treating the unbalanced and excessive use of smart devices, according to what is common among young people, which leads them to a state of addiction to these devices.However, this concept has become somewhat outdated, with the concerted efforts of studies that have proven that the original essence of the pattern of use of these smart devices by young people is that they are in a stimulating state of deep engagement with these devices, which is called cognitive absorption.

It is clear from **Agarwal & Karahanna** (2000) that cognitive absorption is a state of deep engagement or overall experience of an individual with information technology.The first aspect of this engagement shows that, in its extreme, it may lead to a situation in which young people may lose consciousness with external events because they are too preoccupied or absorbed.This is due to what

these smart devices give them: the freedom to communicate, socialize and search for information in ways that were almost unthinkable during previous decades. (Arguedas, M. R., 2009)

Cognitive absorption, according to **Tellegen and Atkinson**, is a new mental process that comes after having a group of tremendous stimuli in quantity and quality, that stimulate the attentional, cognitive and emotional activity, processed by the brain at the same time.Thus, they result in periods of undivided attention that occur when all of a person's ability to pay attention is directed to a particular focus.We will explain by dividing the research groups into three parts: the personality trait of absorption, the state of flow and the concept of cognitive engagement. Furthermore, cognitive absorption is defined as the dimensions related to situations (temporal disengagement - absorption or focus - increased enjoyment and (vigilance) – sense of control - curiosity (the ability to be mentally stimulated), which reflects the ease of use and the great interaction with smart devices.Therefore, this makes the user of these means live in a state of insensitivity to the concept of time and those around it, which leads to enjoyment and a deep desire to engage intensively with the contents of smart devices.

Cognitive absorption has been used primarily to discover patterns of user behavior towards smart devices. Thus, according to Argued and Lin (2009) cognitive absorption significantly influences behavioral intent through the smart devices' perceived usefulness and ease of use.There is a major research that aims to understand the behavioral intention of cognitive absorption, and it found that cognitive absorption has a significant impact on the behavior of young people who use smart devices (Chandra, Srivastava & Themg: 2012). Moreover, it is supposed to help in better understanding the user's belief formation on the other hand. (Meulmans, C. J. 2006)

Cognitive absorption can also be defined as a measurement used to assess user interaction with smart devices.The authors define absorption as a state of deep interest and engagement, the tendency toward aspects of complete attention, ie perceptual, sensory, activity, imagination and thought.Interaction with smart devices is not only about outward oriented cognition but also inward oriented cognition.Studies dealing with young people's interest have made significant progress in understanding how they use smart devices. Despite this, more emphasis has been placed on external goal-oriented activity that requires focused external attention and little or no focus on internal activity directed towards the desired goal.

Executive functions are fully appreciated as a result of their impact on cognitive and emotional functions in general, and on cognitive inhibition and self-regulation in particular.Executive functions are a set of different interconnected abilities that carry out intended and goal-directed action and solve problems. Executive functions are also defined as supra-knowledgeable functions that manage multiple sub-domains of thinking and behavior**.**

The executive functions are the ones that activate and manage thoughts and actions, and this importance can be attributed to their ability to control direction, planning and appropriate mental performance **.**

As **Barkley** explains, executive functions represent a form of behavior evolving from a general response to a specific response as a means of self-regulation.It transforms and adjusts behavior from the immediate social and therapeutic context of self-regulation through internal reflection linked to future social assumptions and predictions.It also fulfills biological requirements, and solves some adaptation problems such as cooperation, social interaction, imitation, learning and motor communication. Executive functions are seen as cognitive processes in which the senses, emotions and motives overlap, and this intervention provides a set of mental methods that contribute to functional adaptation and allow simulation of actions within specific frameworks. (Cox, A. F. 2013)

Planning is the general ability to identify and organize the stages necessary to carry out a desired action and entails several partial capabilities of planning.**Wilensky** highlights the dynamic nature of planning, pointing out that planning is constantly changing in the light of feedback and new information.In addition, it is not possible to create a complete plan before implementation, and this is due to the fact that this task is very exhausting or takes a long time.On this basis, the plan evolves as the task grows.However, in a new situation, when our reactions are not enough to respond appropriately and there is no scheme that can be activated, the supervisory, attentional system intervenes to analyze the situation,

determines the goal, prepares the scheme, implements the task and checks if the results are consistent with the established objectives **(Meulmans: 2006, 48)**.

It is also noticeable that young people who think flexibly work to change their thinking and views when they gain new and accurate information, even if this information does not agree with their fixed beliefs.They can also see the big picture and meaningful detail. Cognitive flexibility is a cognitive ability that is acquired through experience and practice, depending on the modification of cognitive strategies in solving mental processing for new situations in the surrounding environment.

It provides people with the ability to be aware of everything that is going on around them and flexibility in dealing with the difficulties and problems they are exposed to.

Some researchers believe that cognitive flexibility is positively affected by the presence of high motivation and clear vision.Therefore, the development of cognitive flexibility in young people to high degrees makes them able to solve problems more effectively compared to others who do not have this ability as this cognitive process liberates their mental processing resources to adapt to new situations.

Working memory is defined as the cognitive ability responsible for storing and processing information cleverly, or it is called the working memory as it helps to temporarily retain information.This memory is based on the visual image, thanks to the famous cognitive psychologist **Neisser** when he proposed this name.He is also the one who used the concept of Eidetic memory to denote the visual impressions that make the stimuli that receive this memory available for processing even after the disappearance of these stimuli.**Haberlandt** (1999) indicates that visual memory is known as icon memory because it is concerned with receiving real images of external stimuli as they are in reality, and they are preserved in the form of a fantasy known as an **icon**.Bruce & Green & Ceorgeson 2003 also see that what is encoded in this memory is superficial information about the properties of physical stimuli such as color, while it is difficult to extract any meaning for stimuli in this memory. (Diamond, A. 2013)

On this basis, the need arose to conduct this study in order to study the relationship between cognitive absorption and some executive functions among young users of smart screen devices.In other words, the current study attempts to answer the following questions:

2- Questions:

1- To what extent are young people of the study sample cognitively absorbed in smart screen devices?
2- Is there a statistically significant correlation between cognitive absorption and planning function among young people who use smart screen devices?
3- Is there a statistically significant correlation between cognitive absorption and cognitive flexibility among young people who use smart screen devices?
4- Are there statistically significant differences in cognitive absorption according to the electronic medium in each dimension separately?
5- Is there a statistically significant correlation between the efficiency of visual working memory and cognitive flexibility among young people who use smart screen devices?

3- Hypotheses:

1- We expect that the percentage of cognitive absorption will be high among young people who use smart screen devices.
2- There is a statistically significant correlation between cognitive absorption and planning function among young people who use smart screen devices.
3- There is a statistically significant correlation between absorption and cognitive flexibility among young people who use smart screen devices.
4- There are statistically significant differences in cognitive absorption according to the electronic medium in each dimension separately.
5- There is a statistically significant correlation between visual working memory and cognitive flexibility among young people who use smart screen devices.

1- Study Methodology:

Most studies followed a scientific method to investigate scientific facts, meaning that the method is the systematic approach used in researching a topic. The method of research varies according to the nature and objective of the topic being studied.

Since the study problematic is about the possibility of having a relationship between cognitive absorption and some executive functions, we believe that the descriptive approach is the most appropriate approach to carry out the study.This approach is: "A process of accurate monitoring and follow-up of a particular phenomenon or event and describing it in a quantitative and qualitative manner in a specific time period or several periods. Its aim is identifying the phenomenon from the content, analyzing and interpreting it in order to reach results that help in understanding and developing reality" **(عليان وآخرون: 2000, 47)**.

2- Study community:

The original study community consists of Kasdi Merbah University of Ouargla students, for the academic year (2020/2021).Their number is (10537) male and female students, aged between (18/36 years), distributed among 3 faculties of the Kasdi Merbah University of Ouargla.

3- Study sample:

The selection of the sample is considered one of the most important methodological steps of the study, because its results are based entirely on the characteristics of the sample and the extent to which it represents the original community in order to generalize its results to the members of the community.The researcher relied on a set of variables in selecting the sample, which are as follows (electronic means - languages).In addition, the sample is chosen purposely for a set of reasons that take into account (targeting the youth group of university students - owning smart devices - using social media).

The study is conducted at the level of 3 faculties of the Kasdi Merbah University of Ouargla during the month of March for the university season (2020/2021).The study sample is (131) male and female students distributed over 3 faculties (Faculty of Fuels - Faculty of Mathematics and Material Sciences - Faculty of Economics and Management Sciences).After canceling about (17) formsbecause they do not meet the conditions for applying the study, the sample became estimated at (114) male and female students whose ages range between (18/36 years).

Table No. (1) shows the study sample members distributed by colleges and according to:

Statistical indicators / Departments	Gender		Total summation	Total percentage
	Female	Male		
College of Hydrocarbons	4	23	27	23.7%
Faculty of Mathematics and Material Sciences	35	12	47	41.2%
Faculty of Economics and Management Sciences	28	12	40	35.1%
Total summation	67	47	114	100%

4- Study tools:

In any study, researchers resort to choosing the appropriate tools for data collection and analysis, based on the nature of the research topic, the type of the data, and the objectives they seek.

1: Cognitive Absorption Scale (prepared in the current study).
2: Tower of Hanoi Test (application).
3: T.M.T Test (Application).
4: A measure of pattern recalling for visual memory.

The following is a description of the measurement tools adopted in the current study:

4-1: Cognitive Absorption Scale:

The current study includes a measure of cognitive absorption thatis prepared by the researcher after reviewing theoretical literature on cognitive absorption.Then the researcher formulated the paragraphs of the scale consisting of 31 paragraphs and wrote them in the first person form, and it includes measuring five basic dimensions:

- Temporal separation
- Immersion / Focus
- Increased enjoyment/ (vigilance)
- Sense of censorship
- Curiosity/ (mental arousal)

Students answer this scale by answering all of its paragraphs by placing an (x) in front of the paragraph that corresponds to the alternative answers (always - sometimes - never).The scores were

distributed according to the order as follows (2-1-0) in one direction, and the high degree indicates the high level of cognitive absorption and the low degree on the scale indicates its low level.

The objectives for which the cognitive absorption scale is designed:

* Detection of the extent to which students enter into a state of cognitive absorption while using smart screen devices.
* Knowing the extent of cognitive absorption spread among young people who use smart screen devices.
* Knowing the extent of the impact of cognitive absorption on the behavior of young people who use smart screen devices.
* Studying the cognitive skills exerted during the cognitive absorption of young people using smart screen devices.

Psychometric properties of the cognitive absorption scale:

The scale is applied to an exploratory sample of male and female students, an available sample of 55 male and female students ranging in age from (18-28 years). It is selected from faculties (Faculty of Law and Political Science, College of Literature and Languages, College of Humanities and Social Sciences, College of Modern Information and Communication Technology).In order to calculate the validity and reliability of the scale, (12) questionnaires have been canceled due to their lack of the necessary conditions for acceptance.

Trustees' validity: The researcher made a set of modifications to the tool before presenting it to the group of five Trustees in order to express their opinion and judge the validity of the statements content.They gave their remarks, which the researcher took into consideration.

Measuring honesty by the peripheral comparison method:

After arranging the scale scores in descending order from largest to smallest, 33% of the upper level were compared with 33% of the lower level. Then, a t-test was applied to indicate the differences between the mean of the two samples, and the result was as shown in the following table.

Table No. (2): the arithmetic mean, standard deviation, the calculated “t” value and its significance.

Statistical technique Scores	No.	Arithmetic mean	Standard deviation	"T"-value	Degree of freedom	Significance level
Low scores	15	30.13	2.50	13.073	28	0.000
High scores	15	43.66	3.13			

Based on the previous table, the calculated "T" value is equal to (0.73,13) at the degree of freedom (28) at the significance level of 0.000, which indicates the discriminatory ability of the tool and thus the tool measures what it is set for.

Measuring the validity using the internal consistency method

The internal consistency of the cognitive absorption is calculated by calculating the correlation coefficient between each item and the total score of the scale. The results obtained are shown in Table No.3.

Table No. (3) Correlation coefficients between the sub-scales of the cognitive absorption scale

Dimensions	Pearson correlation coefficient	Significance level	Result
1. Temporal separation	0.481	0.000	Significant
2. Immersion / Focus	0.708	0.000	Significant
3. Increased enjoyment/ (vigilance)	0.663	0.000	Significant
4. Sense of control	0.565	0.000	Significant
5. Curiosity/ (mental arousal)	0.622	0.000	Significant

Through the shown results, it is clear that all the correlation coefficients extracted between the dimensions of the scale and the total score are significant and positive, which confirms the validity of the scale.

Measuring stability using the split-half method:

Table No. (3) Stability coefficient by split-half method:

Sample	"r" calculated	"r" modified	"r" tabular	Freedom degree	Significance level	Statistical decision
43		0.81	0.69		0.01	Significant

The reliability coefficient is found by using the split-half method between the first half of the scale (item 1 to item 16) and the second half (item 16 to item 31). The stability coefficient after correction is (0.81) (see Appendix No. 6).

Stability measurement using Alpha Cronbach method.

Table No. (4) Stability coefficient by alpha-Cronbach method for scale n = 30

Number of items	Alpha Cronbach
30	0.773

The stability coefficient is calculated using Cronbach's alpha method, and it is estimated at (0.77) after deleting item No. (09), which is a high value that confirms the stability of the scale (see Appendix No. 6).

4-2: Tower of Hanoi Test

This test is one of the popular research tools in cognitive research that aims to measure planning as a special executive function while an individual is solving problems.The design of this test is attributed to the French mathematician Édouard Lucas in 1883.The test consists of a wooden device consisting of a base with three vertical columns, and three circular pieces of different diameters and colors placed on the first column located to the left of the examinee.The goal here is to move the circular pieces one by one to the column that is located to the right of the examinee.However, this transfer process is limited to the condition that the circular piece of larger diameter is not placed on the circular piece of smaller diameter, and that one disc is moved every time the examinee moves the circular pieces to form the required tower.

The original method for conducting and correcting the test:

The examiner presents cards with printed shapes and asks the examinee to form using them, at the end of each attempt, the shape of the tower to be executed using the circular pieces. The researcher leaves the card to the examinee to study the form to be implemented. The application of the test takes 10-15 minutes.The score of the examinee is determined by the number of his/her movements and the time s/he takes in solving it.Each task is given two attempts to solve, and if the examinee is able to implement the final required form during the two attempts, s/he will receive (6) scores.The scores decrease with the increase of the number of attempts in which the desired final form is performed.

Due to the availability of the test in the electronic version, it was applied using smartphone (application), while adhering to all the procedural steps of the test.

4-3: T.M.T Test:

It is a test extracted from (Army individual test battery) in 1944 that measures in its first stage (A) perceptual-cognitive-motor speed, while in the second stage (B) it measures the mental flexibility abilities.The test consists of 04 papers, an experimental paper for stage (A) and one for stage (B), and a test paper for stage (A) and one for stage (B).

***Instruction:**

As for the stage (A) and the part of the experiment, it is: "In this paper you see circles with numbers from 1 to 8 inside.Using the pen, link these circles with respect to the ascending order of the numbers: ie from 1 to 2 and from 2 to 3 and so on.You have to keep the pen on the paper all the time, that is, do not lift it from the paper, and work at full speed without making a mistake, are you ready? Let's go".The examiner must ensure that the examinee understands well what is requested of him/her.

As for the instruction of the test, it is: "Now we will start the test on this paper. You see numbers from 1 to 25. The place from which you have to start is shown here (we show him/her the beginning) and here the test ends (you show him/her the end).You have to connect the numbers in the same way with respect

to the ascending order, keep the pen on the paper and work as quickly as possible without making a mistake, are you ready? Let's go".

The time is calculated and if the examinee makes a mistake, s/he is asked to continue without stopping the time from the place of the error.

For stage (B), the instruction for the experimental stage is on this sheet of paper, as before, we find numbers and also letters. You have to work here in ascending order.However, this is done by connecting alternately between the first number with the first letter, then the second number with the second letter, and so on.For example, on this paper, you have to link the number 1 to the letter A, then the letter A to the number 2, and link it to the letter B, etc.You have to always keep the pen on the paper, that is, do not lift it and work as quickly as possible without making a mistake, are you ready? Let's go.

*** Correction:** We calculate the time for part B and A in seconds and count the number of uncorrected and corrected errors. Then calculate the time difference between A and B.

The test procedures were carried out following the paths with the study sample in its electronic version, that is, applied using the smartphone application, with adherence to the original instruction and the correction method for the test.

4-4: Pattern memory test for visual working memory:

It means the student's ability to recall the pattern, which is one of the indicators of spatial visual memory, and it is measured by the degree that the student obtains in performing the task of remembering the pattern (modified by دينا سمير سيد علي).

***Instruction:** A set of visual arrays is presented to you for a few seconds and then disappears.Focus on the colored squares inside the matrix in terms of direction.You are required to focus, and redraw the pattern as you saw it completely in the empty matrix in the answer booklet in front of you.

Note that this task varies in difficulty, as it begins with the first level, in which the matrix consists of a set of squares, where two squares are shaded, and ends with the eighth level, in which the matrix consists of a set of shaded squares, and it is required to measure the ability to remember the pattern.

***Objectives:** To evaluate the visual-spatial notebook in terms of its visual aspect.

***Stop rule:** The test ends when there is a failure in two groups of the same number of squares.

***Note**: The answer is considered correct when the form is correctly reproduced. Self-correction is allowed as long as it is not requested by the examiner.

***Correction**: The visible range is determined based on the longest form in which two attempts have been passed.If the student makes two errors in the series of eight squares, the last observation is that in this range the results range from 0 to 7. (**2013.66: MOLLIERE Anaïs**).

1- Presentation and analysis of the results:

1.1: Presentation and analysis of the results of the first hypothesis:

The first hypothesis states, “We expect that the percentage of cognitive absorption will be high among young people who use smart screen devices.”In order to test the validity of this hypothesis, the frequencies and the percentage of scores for the sample youth were calculated on the cognitive absorption scale, and Table No. (5) presents the results obtained by the youth.

Table No. (5) Repititions and percentage of scores of the sample youth on the cognitive absorption scale:

	Repititions	Percentages
Those with high cognitive absorption	86	75.43%
Those with low cognitive absorption	28	24.57%
Total summation	114	100%

We note from Table No. (5) that the percentage of young people with high cognitive absorption, whose number is(86) individuals, is estimated at (75.43%).Moreover, the percentage of young people with low cognitive absorption, whose number is(28) individuals, is estimated at (24.57%).Thus, the percentage of cognitive absorption is high among young people who use smart screen devices. Height ratios according to the dimensions of the cognitive absorption scale can be clarified from Table No. (6):

Table No. (6) the number and percentages of the high percentage of cognitive absorption amongthe study sample's young people, according to the dimensions of the scale

Dimensions	Items	Absorption degree/level	Sample number	Percentage	Observation Note
1st dimension: Temporal separation	From 1 to50	Less than 8	50	43.85%	Low
	From 51 to 114	More than 8	64	56.54%	High
2nd dimension: Immersion / Focus	From 1 to 39	Less than 6	39	34.21%	Low
	From 40 to 114	More than 6	75	65.78%	High
3rd dimension: Increased enjoyment	From 1 to 41	Less than 7	41	35.96%	Low
	From..to 114	More than 7	75	65.78%	High
4th dimension: Sense of control	From1 to43	Less than 5	43	37.71%	Low
	From 44 to 114	More than 5	71	62.43%	High
5th dimension: Curiosity	From 1 to 29	Less than 5	29	25.43%	Low
	From 30 to 114	More than 5	85	74.56%	High

From Table No. (6) we note that the percentage of the first dimension (temporal separation) for those with low absorption, who numbered (50), is estimated at (43.85%).As for the percentage of those with high cognitive absorption, who numbered (64), it is estimated (56.54%). The ratio of the second dimension (focal immersion) for those with low absorption who numbered (93) is estimated at (34.21%) as for the percentage of those with high cognitive absorption, who numbered (75), it is estimated at (65.78%). Moreover, the percentage of the third dimension for those with low absorption who numbered (41) is estimated at (35.96%), while the percentage of those with high cognitive absorption, who numbered (75), is estimated at (65.78%).While the percentage of the fourth dimension, Sense of control for those with low absorption numbered (43) is estimated at (37.71%), while the percentage of those with high cognitive absorption, who numbered (71), is estimated at (62.43%).The percentage of the fifth dimension, curiosity, for those with low immersion, who numbered (29), is estimated at (25.43%), while the percentage of those with high cognitive absorption, who numbered (85), is estimated at (74.56%).

Figure No. (7) Percentages of the high rate of cognitive absorption among young people in the sample according to the dimensions of the scale
1. Temporal separation
2. Immersion / Focus
3. Increased enjoyment
4. Sense of control
5. Curiosity

It is noticed from Figure No. (7) that there is a discrepancy in the proportions of the dimensions of the cognitive absorption scale according to those with high absorption.The dimension of curiosity got the largest percentage and it was estimated at 74.56%. This indicates that cognitive absorption works to bring young people to explore more of what is found in digital means of knowledge and various topics that stimulate them to maintain a state of immersion.This creates a state of pleasure for them and increases the enjoyment of engaging through various smart devices.The increased enjoyment dimension was estimated at 65.78%, which means that users of smart devices enjoy luxury when they engage with digital activity, and lead them to a state of deep immersion while using smart devices.In addition, the percentage obtained in the focal immersion dimension was estimated at 65.78%, which is a percentage similar to the ratio of the increased enjoyment dimension.However, they have the ability to adjust their behavior to suit the target need for their activity through smart devices, and this is what was indicated by the ratio of the control sensor dimension 62.28%, which is a state of internal balance and good cognitive management.The temporal separation rate was estimated at 56.54%, which is the lowest percentage for those with high absorbtion level.It means that young people have a degree of self-awareness of what they are doing through their use of smart devices, by not ignoring what is happening around them, as they have a sufficient sense of control.

1.2: Presentation and analysis of the second hypothesis results:

The hypothesis states that "There is a statistically significant correlation between cognitive absorption and planning function among young people who use smart screen devices."In order to test the hypothesis, Pearson correlation coefficient is used, and the results obtained are as shown in the following table:

Table No. (7) The value of the correlation coefficient between cognitive absorption and the planning function

Variables	"r" value	Freedom degree	Significance level
Cognitive absorption and cognitive inhibition	0.152	112	0.106

From Table No. (7), it is clear that the value of the Pearson correlation coefficient is (0.152) with a significance level of (0.106) at the degree of freedom (112).This indicates that there is no statistically significant relationship between cognitive absorption and the planning function.

1.3: Presentation and analysis of the third hypothesis results:

The hypothesis also states that "there is a statistically significant correlation between absorption and cognitive flexibility among young people who use smart screen devices."In order to test the hypothesis, Pearson correlation coefficient is used, and the results obtained are as shown in the following table:

Table No. (8) The value of the correlation coefficient between cognitive absorption and cognitive flexibility:

Variables	"r" value	Freedom degree	Significance level
Cognitive absorption and cognitive flexibility	0.063	112	0.507

It is clear from Table No. (8) that the Pearson correlation coefficient value is estimated at (0.063) with a significance level of (0.507) at the degree of freedom (112).This indicates that there is no statistically significant relationship between cognitive absorption and cognitive flexibility.Hence, the research hypothesis which states that there is a statistically significant relationship between cognitive absorption and cognitive flexibility has not been achieved.

1.4: Presentation and analysis of the fourth hypothesis results:

The hypothesis states that "There are statistically significant differences in cognitive absorption according to the electronic medium in each dimension separately".In order to test this hypothesis, a one-way analysis of variance is used, and the results were as shown in the following table (9):

Table No. (9) the results of the one-way analysis of variance test to compare the electronic means in cognitive absorption

Contrast ource Sample	Sum of squares	Freedom degree	Mean squares	F-test value	Statistical significance
Between groups	187.363	2	93.681	1.783	0.173
Within groups	5831.663	111	52.538		
Total	6019.026	113			

Through the previous table, it is clear that the value of the F-test is estimated at (1.783) with a level of significance (0.173), which is greater than (0.05), and this indicates that there are no statistically significant differences in cognitive absorption according to the multiplicity of electronic means.

According to the temporal separationdimension:

Table No. (10) the results of the one-way analysis of variance test for comparison between electronic means in terms of the temporal separation dimension

Contrast ource Sample	Sum of quares	Freedom egree	Mean squares	F-test value	Statistical significance
Between groups	11.437	2	5.719	0.623	0.538
Within groups	1018.923	111	9.179		
Total	1030.360	113			

Through the above table, it is clear that the value of the F-test is estimated at (0.623) with a level of significance (0.538), which is greater than (0.05), and this indicates that there are no statistically significant differences in the temporal separation according to the multiplicity of electronic means.

According to immersion/focus dimension:

Table No. (11) the results of the one-way analysis of variance test for comparison between electronic means in terms of the immersion/focus dimension

Contrast ource Sample	Sum of quares	Freedom egree	Mean squares	F-test value	Statistical significance
Between groups	12.985	2	6.492	1.227	0.297
Within groups	587.270	111	5.291		
Total	600.254	113			

Through the previous table, it is clear that the value of the F-test is estimated at (1.227) with a level of significance (0.297), which is greater than (0.05), and this indicates that there are no statistically significant differences in the immersion/focus according to the multiplicity of electronic means.

According to the Increased Enjoyment dimension:

Table No. (12) the results of the one-way analysis of variance test to compare between electronic means in terms of the increased enjoyment

Contrast source Sample	Sum of squares	Freedom degree	Mean squares	F-test value	Statistical significance
Between groups	6.218	2	3.109	0.547	0.580
Within groups	630.773	111	5.683		
Total	636.991	113			

Through the previous table, it was shown that the value of the F-test is estimated at: (0.547) with a level of significance (0.580), which is greater than (0.05).This indicates that there are no statistically significant differences in the dimension of increased enjoyment according to the multiplicity of electronic means.

According to the sense of control:

Table No. (13) the results of a one-way analysis of variance test for comparison between electronic means in the sense of control dimension

Contrast source Sample	Sum of squares	Freedom degree	Mean squares	F-test value	Statistical significance
Between groups	28.122	2	14.061	4.396	0.015
Within groups	355.036	111	3.199		
Total	383.158	113			

Through the previous table, it was shown that the value of the F-test is estimated at: (4.396) with a level of significance (0.015), which is less than (0.05), and this indicates that there are statistically significant differences in self-control according to the multiplicity of electronic means.In order to find out the differences in favor of any electronic means, the Scheffe test is used for dimensional comparisons. The results are shown in the following table:

Table No. (14): Results of the Scheffe Test for Dimensional Comparisons

Electronic means	No	Average	Binary comparisons	Difference average	Sig. level	Result
(T) Tablet PC	34	5.55	T-S	-0.66	0.223	There are no significant differences
(S)Smartphone	63	6.22	S-P	-0.89	0.191	There are no significant differences
(P)Laptop computer	17	7.11	T-P	-1.55	0.16	In favor of P

According to the table it is clear to us that there are no differences between the two means (smartphone - tablet computer). In addition, there are no differences between the two means (laptop-smartphone).

Furthermore, the differences between the two methods are statistically significant (laptops - tablet computers) in favor of the laptop.

According to the dimension of curiosity:

Table No. (15) shows the results of the one-way analysis of variance test for comparison between electronic means in the dimension of curiosity

Contrast source Sample	Sum of squares	Freedom degree	Mean squares	F-test value	Statistical significance
Between groups	33.541	2	16.771	5.021	0.008
Within groups	370.739	111	3.340		
Total	404.281	113			

Through the above table, it is found that the value of the F-test is estimated at: (5.021) with a level of significance (0.008), which is less than (0.05).This indicates that there are statistically significant differences in curiosity according to the multiplicity of electronic means.In order to find out the differences and in favor of which electronic method, the Scheffe test is used for dimensional comparisons. The results are in the following table:

Table No. (16): Results of the Scheffe Test for Dimensional Comparisons

Electronic means	No	Average	Binary comparisons	Difference average	Sig. level	Result
(T) Tablet PC	34	6.05	T-S	-1.22	0.09	In favor of P
(S)Smartphone	63	7.28	S-P	-0.28	0.849	There are no significant differences
(P)Laptop computer	17	7.00	T-P	-0.94	0.227	There are no significant differences

According to the table, there are statistically significant differences between the two means (smart phone - tablet computer) that were in favor of the smart phone. Moreover, In addition, there are no differences between the two means (laptop - smart phone), and there are no differences between the two means (laptop - tablet computer).

1.5: Presentation and analysis of the fifth hypothesis's results:

The hypothesis states that there is a statistically significant correlation between visual working memory and cognitive flexibility among young people who use smart screen devices.In order to test the validity of the hypothesis, Pearson correlation coefficient is used, and the results are as shown in the following table:

Table No. (17) The value of the correlation coefficient between working memory and cognitive flexibility

Variables	Value of "r"	Degree of freedom	Significance level
Working memory and cognitive flexibility	-0.248	112	0.008

From Table No. (17), it is clear that the value of Pearson's correlation coefficient is estimated at (-0.248) with a significance level of (0.008) at the degree of freedom (112), and this indicates that there is a statistically significant inverse relationship between working memory and cognitive flexibility.

2- Results discussion:

2-1: Discussing the results of the first hypothesis:

The hypothesis states the following: It is expected that the percentage of cognitive absorption is high among young people who use smart screen devices.

The results presented in Table (6) showed that the percentage of knowledge absorption among young people who use smart devices is high.This was demonstrated by the statistical processing of youth scores on the cognitive absorption scale, where the prevalence rate is (75.43), which indicates the realization of the research hypothesis.

This percentage proves that young people today have a high level of smart device use and are characterized by a high level of cognitive absorption.This provides some explanation for the profound state of engagement and interest that some young people may show when interacting with intelligent machines, to intermediate environments that may reinforce technology-related behaviors.**Agarwal and Karahanna** (**2000**) explain cognitive absorption as a major container for prominent beliefs about information technologies, whereby smart devices give freedom to communicate, socialize, and search for information in a way that was previously unimaginable.This does not mean that they do not interact with each other only, but that the place of this interaction has taken a radical shift in type and scope.However, smart devices, while easy to share, may not be in the interest of young people when they seek to maintain luxury.This may be partly due to their level of cognitive absorption when engaging in social media sites, as they feel more cognitively absorbed in the medium, and tend to give up other activities and instead continue to engage in social media.**Magni (2010)** sees that the individual's behavior is based on the motivation to engage in activities that are considered self-sufficient without searching for the results of this activity.As for the study of **Bozoglan, Demirer and Sahin (2014),** it confirms that cognitive absorption leads to an increase in the dependent and actual use, a feature that leads to a sequence of total interest in knowledge where young people expend their energy towards it.It is a state of idealized experience, or a state of inclusion that derives from the inner drive of young people so that they are able to enjoy their cognitive activity regardless of external rewards.**Barnes and Pressey (2017)** suggest that addiction to virtual worlds has a positive effect on cognitive absorption.Examining the relationship of absorption and addiction gives us the ability to understand the pathways through which behaviors related to smart devices are embodied.Cognitive absorption determines the individual's state of deep interest in interactive activity. It is understood as an indicator of optimal use of smart devices.According to **Saadè and Bahli (2014)** the experience of immersion leads to a positive attitude towards target behavior in the use of smart devices.Thus, broad explanations of why users behave in particular ways toward the device tend to focus primarily on performative beliefs as drivers of individual use intentions, providing interesting opportunities for the generation of subjective knowledge. (Diamond, A. 2013)

2-2: Discussing the results of the second hypothesis:

This hypothesis states that there is a statistically significant relationship between cognitive absorption and planning function among young users of smart screen devices.

The results of the statistical analysis presented in Table No. (8) showed that there is no statistically significant relationship between cognitive absorption and the planning function, where the Pearson correlation coefficient was estimated at (0.152) at the significance level (0.106), which means that the research hypothesis was not achieved.

This indicates that there is no correlation between cognitive absorption and the planning function, as planning decreases with cognitive absorption.This is because the first requires the formation of sound mental cognitive schemes to face daily events and situations, while absorption is based on the continuity and maintenance of the same mental pace.This means that the user has a greater focus on the internal activity directed towards a particular goal when using smart devices.**Vallerand (1997)** explains that intrinsic motivation occurs when an activity is an end in itself and provides satisfaction for young peopleand this is what drives them to engage intensely.However, overall experiences with technology as captured such as enjoyment and flow are important explanatory variables in theories of technology acceptance.The behavior of young people becomes driven towards the use of smart devices without regard to the results, which leads to a difficulty in the effectiveness of the planning function.**Shgirat (2015)** notes that planning measures a person's ability to manage future skill requirements within the attached context.The planning element in this scale is linked to evidence related to the ability to anticipate future events, provide and define goals and instructions, and develop appropriate steps.Good strategic planning reduces the cognitive load that a deep focal state creates.Given what the researcher noticed while conducting the Hanoi Tower test on the study sample, there are some difficulties that young people

faced in their implementation of the application that contribute to reaching the completion of what is required of them.Absorption makes it difficult for them to find a pattern of logical sequence of the stages of cognitive processes that they use to reach their goals.Thus, cognitive absorption acts as a strong motivating factor towards beliefs related to smart screen devices.Attractive and exciting experiences for young people lead to a deep interest in the content of the device, and this affects the executive functions, making it unable to activate the planning function to accomplish the mental tasks.This is due to full immersion and participation in digital activity which clearly hinders the ability of young people to start tasks in their limited time and obtain the necessary materials to implement the skill in an effective manner to achieve the desired goal.

2-3: Discussing the results of the third hypothesis:

The hypothesis states that there is a statistically significant correlation between cognitive absorption and cognitive flexibility among young people who use smart screen devices.

Through the results that are presented in Table (9), there is no statistically significant relationship between cognitive absorption and cognitive flexibility.The Pearson correlation coefficient is (0.063) at the significance level (0.507), which means that the hypothesis is not validated.

This indicates the relationship between cognitive absorption and cognitive flexibility that is not statistically significant and is a very logical result.This is because cognitive flexibility is the ability to change mental strategies based on a new focus of interest that requires different planning.However, cognitive absorption always calls for keeping young people in the same focus. If it is changed, this change does not modify the context of the first plan to the extent that activates the executive function and flexibility, and to the extent that it is difficult for young people to form mental skills to move from one stage to another automatically.This is the result of a state of deep engagement with smart devices, which makes young people more immersed and ignorant of the external environment .This was confirmed by **Agarwal and Karahanna (2000)** who think that cognitive absorption is a state of strong dependence on technological experiences and that the focus of attention is that state in which attention is focused on the activity when interacting with smart devices.Here, the behavior of young people is motivated by the impulse to engage in the activity, and this is what **Csiksezentmihalyi** describe as flow is a state of deep immersion in an activity that is naturally pleasurable and in the same way without employing mental skills.Through the results of the TMT test, the researcher noticed that there is a difference in the time taken between stage A and stage B.There was difficulty, especially in stage B (associating numbers with letters), where most of the young people had difficulty searching for the next number or letter.Hence, there is a lack of the ability to divert the course of thinking towards the situations they are addressing.This means that when young people are in a state of deep interest and focus on the task at hand without devoting their mental resources, the use of the flexibility function gets disrupted.Therefore, cognitive absorption affects the cognitive flexibility in not creating mental strategies that generate new ideas to confront obstacles and deal with them in a smooth way to maintain the pace of interaction with smart devices. (Miller, E. K., 2001)

2-4: Discussing the results of the fourth hypothesis:

The hypothesis states that there are statistically significant differences in cognitive absorption according to the electronic medium in each dimension separately.

Through the results mentioned in Table No. (10), it is clear that there are no statistically significant differences in knowledge absorption according to the number of electronic means, where the value of the test (q) b (1.783) at the significance level (0.173). This means that the research hypothesis is not validated.

The results show that when young people use various electronic means, they become characterized by a high degree of immersion.Most of the smart devices attract young people to participate in depth to provide various requirements of information and entertainment programs that keep them engaged with digital activity.This makes them more willing to reveal all the apps that these devices contain and browse through them to learn more.**Reychav and Wu 2015** show that cognitive absorption is accompanied by a

state of intrinsic motivation that in turn affects an individual's activity.It is a behavior in which the user becomes completely immersed in the world of knowledge while interacting with smart devices.This process is characterized by full attention, participation, a sense of control, enjoyment and curiosity, due to the large number of digital programs and applications, which work to attract the attention of young people and keep them at the same pace of deep immersion with smart devices.Bagozzi et al stress that in order to explain and increase user acceptance of information technology it is necessary to reveal why people accept or reject smart devices. (Stuss, D. T., 2000)

Cognitive absorption is a precedent for behaviors such as young people's perception of the usefulness or ease of use of smart devices.This, in turn, affects the intention of young people regarding the use of a certain technology. According to **Agarwal and Karahanna (2002)**, as part of understanding the intent of young people to use smart devices, engagement shows how technology enables interaction to become more attractive for young people,which is addressed through the five dimensions.The first dimension of this structure shows that in the extreme, this participation may lead to a situation in which young people may lose awareness of external events because they are too preoccupied with applications.This is known as temporal disengagement, meaning that awareness decreases over time when engaging in digital interaction.The next dimension shows that when young people are engaged in an activity, they may tend to ignore other interests and focus only on technological interaction, which is known as immersion or focus.The third dimension is increased enjoyment, that is, when young people indulge in technological activity, they experience a level of enjoyment that can be measured by their increased persistence on smart devices.This is generally true in most electronic devices, but this dimension is more prominent when young people are using laptop computers.According to the previously mentioned statistical results, there are statistically significant differences between the two means, a tablet and a laptop, and they were in favor of the laptop.This means that young people have a greater sense of self-awareness when they are in front of their laptop.Furthermore, the fifth dimension addresses the extent to which the experience affects the sensual and cognitive curiosity of young people when being deeply immersed in an activity.Smartphone users have a high level of curiosity which gives them the freedom to communicate and interact with a degree of comfort, better than other devices such as laptops and tablets.The results agree with the flow theory, which emphasizes the extent to which full participation is achieved during the performance of an activity, which leads to urging users to continue and engage in participation in a form of enjoyment and satisfaction. (Anderson, P. 2002)

2-5: Discussing the results, the fifth hypothesis:

The hypothesis states that there is a statistically significant correlation between visual working memory and cognitive flexibility among young users of smart screen devices.

The results in Table No. (18) indicate that there is a positive relationship between visual working memory and cognitive flexibility.The value of the correlation coefficient was (-0.248) at the significance level (0.008), which validates the research hypothesis.

This relationship indicates that visual working memory is a basic cognitive ability to process information and immediately absorb it through mental cognitive domains.This helps young people to adapt strategies of cognitive processes to face unexpected events in a flexible way, and these findings are consistent with the study of **Moradzadeh (2009).**The latter concluded that the factors that can contribute to cognitive flexibility in adults are the speed of processing and keeping pace with situations, by evoking visual working memory skills, which achieve effective competencies and strategies in employing mental processes.Cognitive flexibility is one of the most prominent executive functions that distinguishes the individual and means the ability to make automatic changes to various situations.The study of **Abdel-Wahab (2011)** concluded that individuals who are characterized by cognitive flexibility are those who strive to achieve their goals, through their mental capabilities to produce different solutions towards a specific situation.In addition, the use of the visual component may reflect positively on the ability to acquire and learn new skills, which helps young people to employ it when needed.Moreover, the relationship between cognitive flexibility and visual working memory is shown through **Baqei's study (2013),** which states that there is a statistically significant correlation between cognitive flexibility and memory strategies among university students.According to **Baddeley**'s hypothesis, there is a basic system responsible for controlling visual working memory, and it works to retain and process sequential information at a certain time.It depends on the interaction between its components, namely the ability to store and the ability to process information, and helps young people to generate a variety of responses that

show unfamiliar uses of something familiar.Therefore, cognitive flexibility is closely related to visual working memory, as visual working memory is an important cognitive component for young people to practice storage and information processing, and they apply mental cognitive strategies to find positive solutions to certain situations.

General conclusion:

The current study reached the following results:

- Cognitive absorption helps in producing new ideas for young people who use smart screen devices.
- Digital devices have enabled a state of engagement in the world of information and general knowledge, providing a space and an outlet for youth to entertain.
- Cognitive absorption contributed to reducing the activity of some executive functions during the deep participation in the performance of a particular task.
- Some previous studies agree with the current study, as they confirm the benefit of young people's use of smart screen devices, allowing them to feel content and enjoyment to reach the state of immersion in the task.
- Young people have mental characteristics that help them to form new cognitive skills to keep pace with the various aspects of life.

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