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Cognitive Load of University Students and its Relationship to their Academic Achievement

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ABSTRACT

The research aims to identify the amount of cognitive load among students of the Department of Mathematics with level of academic achievement in general mathematics information; and the relationship between cognitive load and academic achievement in general mathematics information. The sample consisted of (200) male and female students from the Department of Mathematics who were chosen randomly. To achieve the objectives of the research, a tool was built to measure the cognitive load consisted of (21) items, and the validity and reliability of the tool were verified authenticity and constancy by using (percentage, Pearson correlation coefficient and one-sample t-test) as statistical means. It was concluded that the research sample has a cognitive burden. The mathematical activities, skills and tasks practiced by the students of the mathematics department contribute to increas the cognitive load. They possess a comprehensive mathematical knowledge of concepts, skills, principles and problems, which represents their academic achievement in mathematics. The cognitive load is positively correlated with academic achievement. The researchers came up with a set of recommendations and suggestions.

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Introduction

Knowledge is one of the qualities that God Almighty distinguished man from other creatures, and the student must be well prepared and must possess a lot of information and knowledge of all its patterns, acquisition and practice. Learners to use this knowledge appropriately in facing the issues they face, which develops their general problem-solving skills, and helps them analyze the totality of educational ideas and issues with a careful look, enhance their self-confidence, and help them adapt to the current situations and developments.
Mathematical scientific knowledge with its various components (concepts, principles, skills and issues) is one of the types of direct educational experiences and its acquisition passes through multiple educational-learning stages and steps that differ according to the age and school stages that the student goes through, which may sometimes exceed his memory capacity and contradict his method of processing information and this may be called a burden, and a mental effort for the knowledge it carries, and it is of particular importance to this research, which represents a clear challenge at this particular time. We use blended learning as a result of the (COVID-19 pandemic and crisis), where the focused attention to processing information is affected by

multimedia, which occurs when you need separate sources of information (such as audio, group text chat , private text chat, and watching avatar movements) to mental integration and attention to achieve a better understanding.

The process of listening in learning mathematics is limited, as well as the process of retrieving information from memory and processing it, and its success and failure greatly affect understanding, in addition to the electronic programs used and the options and performances they contain, which in their entirety represent an additional burden and burden to scientific mathematical knowledge and contribute to its acquisition and application for the university students.

Given the importance of knowledge and its applications for the university student and the clear interest in it in most international and Arabic studies, which has a significant impact on his performance and achievement in classroom situations, especially students of the mathematics department in the faculties of education, which in turn has great repercussions on their achievement and the achievement of their students later in all the subjects they study, so the problem The current research is summarized by answering the following question: What is the level of the mathematical cognitive burden among students of the Department of Mathematics in the College of Education - Al-Mustansiriya University, and what is its relationship to their academic achievement?

The importance of the current research is represented in the importance of each from the point of view of the students of the Department of Mathematics and their opinion of the reality of the cognitive burden and mental effort in the study of mathematics. Acquisition and application of general mathematical knowledge. The lack of recent research conducted in this field at the local level. The research provides a tool for measuring the mathematical cognitive load that can be used, a theoretical framework that sheds light on the theory of the cognitive load and its types. Also the current research is limited to students of Al-Mustansiriya University, College of Education / Department of Mathematics for morning studies / for the academic year (2020/2021)

Theoretical Background and Previous Studies:

Cognitive load

The development of the cognitive burden theory began in the late seventies of the last century with a focus on problem solving, and the cognitive burden theory was built on many researches in the fields of (educational psychology) and (cognitive psychology). Miller’s 1950 research and Badley’s research were among the most important research on working memory on which this theory is based [1,2]. The theory of cognitive load is broadly related to the framework of information processing and the learner's use of memory, which consists of three main parts: sensory memory, working memory, and long-term memory. Specialists have added many things to this principle as a result of continuous scientific and educational development [3,4]. This theory asserts that a person who takes new information needs the ability to have time to understand and integrate new information with previous information to organize and form a new understanding of the world around him. Also, the amount of information processing activity is focused on working memory and its effectiveness in using the total amount of mental activity that can be Working memory has to deal with, and this theory suggests that differences in performance are due to the total volume of mental activity used to store information in working memory, and simultaneous visual and auditory processing of information can cause cognitive overload due to limited cognitive processing capabilities[5-7].

It is the information imposed on the working memory for the purpose of storage and processing; and it is defined procedurally by the amount of mental activity that the student of the Mathematics Department in the College of Education exerts during his processing of information to perform a task, represented by the degree that the student obtains when responding to the items of the cognitive burden scale prepared for this purpose [8,9]. There are three types of cognitive load: intrinsic intrinsic load, extrinsic or passive intrusive load, and close effective load. Intrinsic cognitive load refers to the cognitive load caused by the structure and complexity of the learning material, wherein teachers or instructional designers cannot do much to affect the core cognitive load. Intrusive cognitive load refers to the cognitive load caused by coordination and the way information is presented, finally, close cognitive load refers to the cognitive load caused by the learners' efforts to process and understand the material [10,11].

The goal of CLT is to increase this type of cognitive load so that the learner can have more cognitive resources available to solve the problems they encounter. Cognitive psychologists have introduced the term "cognitive load" to refer to the amount and processing of information necessary in a learner's working memory (the part

of short-term memory involved in conscious perceptual and linguistic processing). The amount that can be processed without causing cognitive overload depends on the amount of working memory the individual has and the amount of information the learner can retain in the short-term memory. People are inherently limited in the amount of cognitive load they can tolerate, and thus easing the cognitive load is one of the main goals of the educational process [12-14].

Principles of cognitive load theory in the learning and instruction design process:

1- practical examples: it helps the learner to save time and effort during the learning process and solve problems.
2- complementarity: it helps learners to build cognitive schemes in solving problems 3- The principle of focusing attention: it presents an integrated text.
3- assortment (the model): the investment of the two sub-components in working memory (visual and spatial) and the audio loop in reducing the cognitive burden.
4- amplitude: that is, it is the lack of repetition in the process of presenting information in two different forms.
5- lack of experience: It is the presence of differences between educational designs according to the learner's experiences.
6- isolating the interacting elements: This principle emphasizes separating and sorting the interacting elements in educational situations and presenting them separately, in order to reduce the level of cognitive burden and the occurrence of learning.
7- imagination: it means imagining concepts or issues during the learning process.
8- gradual fading of directions: This principle is related to the first and second principles, whereby the novice learner is directed to the steps of solving examples based on the cognitive scheme, and problems are designed in the form of questions and asked to be solved with the aim of canceling the directions. [15-20]

It can identify and promise as sources of mental effort exerted by the learner in the process of teaching and learning. These types have gone through the stages of development of the cognitive burden theory, and these types are : Internal cognitive load which is also called (the intrinsic cognitive load) and this type is determined by the complexity of the educational tasks, i.e. the amount of interactive elements that must be treated at the same time [21,22], it helps the designers of the educational process to build information in an appropriate manner because it will reduce the internal cognitive burden as well as it helps to exclude any mental activities that are not directed to building and acquiring cognitive structures, and that it arises from the nature imposed by the information presented, as some materials are difficult to learn because they require the treatment of many elements that are intertwined at the same time [23,24].

External cognitive load; it is also called (the extraneous cognitive load), this type is attributed to the teaching methods used to present information to the learner, such as maps, concepts and drawings. The learner possesses knowledge about that subject, and the learner in such a case learns by any educational media, and then the learning will be successful, on the contrary, if the internal cognitive load is high (difficult content), and the teaching methods that are used to present the information are high burden, that is, inappropriate, and the total cognitive load It outperforms the capabilities of working memory, and then the learner fails [25,26], this kind of cognitive burden occurs as a result of the educational sub-strategy and the processes that are related to it and that do not contribute to the learning process, such as dealing with distracted attention [27,28].

Relevant cognitive load is the closely related cognitive load differs from the previous two types, in its positive relationship with learning, because it arises as a result of devoting knowledge resources to the acquisition and formation of cognitive structures Cognitive [29-31]. This kind occurs due to the correct educational strategy as well as the processes associated with it in the educational process such as induction and prolongation. The interacting elements gradually. In the early stages of the learning process, the internal cognitive burden is determined by the lack of interactivity of the elements as well as the learner’s lack of experience, so that the learner with high rates has types of knowledge as it enables them to treat a group of interlocking elements as one element, accordingly the more the learners’ experience increases, the more they become able to withstand higher levels of interacting elements [32-34].

Academic Achievement

It is the information and skills acquired by learners as a result of studying a specific subject or unit of study." Academic achievement is defined procedurally as the level of information and skills of the student of the Mathematics Department at the College of Education - Al-Mustansiriya University, represented by the degree he obtains in the achievement test prepared for this purpose [35].

Previous studies

Table 1

Previous studies

	Name; Year; Country	Study	Sample	tools	Result
1	Al-Abadi; 2014; Iraq	the relationship of the cognitive burden to the self-ability of the students of the University of Diyala	(400) male & female	adopted the Self-Ability Scale	there are no statistically significant differences for the gender variable. Confrontation
2	Al-Sabab; 2016; Iraq	cognitive burden and its relationship to mental capacity according to its levels among university students	(400) male & female	a measure of cognitive burden as well as a measure of mental capacity	that undergraduate students in scientific faculties have a high level of cognitive burden, and the results showed that undergraduate students have average mental capacity for males and females, while the mental capacity of students in scientific faculties is wider than human faculties, the results also showed a correlation between cognitive burden Mental capacity according to the variable of gender and specialization
3	Khalil; 2019; Eygept	reveal the differences between the sexes on the dimensions of the cognitive burden among graduate students	(60) male & female	Helmy El-Feel Scale (2015)	there were no statistically significant differences between the mean scores of the two groups (male and female) in the cognitive burden scale and its dimensions

Method

To achieve the objectives of this research, the researchers used the analytical descriptive research method, due to its suitability to the subject of this research in terms of describing the phenomenon, analyzing it and finding the relationship between the variables of this research. The population of this research consisted of all the students of the Mathematics Department of the morning study - College of Education / Al-Mustansiriya University for the academic year (2020-2021), and their number was (839) male and female students. As for the research sample, it includes the exploratory sample on which the research tool was applied and it consisted of (30) male and female students who were randomly selected from the Mathematics Department - College of Education / Al-Mustansiriya University in order to verify the stability of the research tool. And the original research sample, as the research tool was applied to the original research sample, which consisted of (200) male and female students who were randomly selected from the total research community from the Department of Mathematics - College of Education / Al-Mustansiriya University.

The two research tools: In order to measure the cognitive burden included in this research, a scale was built to measure the cognitive burden in mathematics, where this scale consisted of (21) items distributed over three dimensions (the intrinsic cognitive burden, the extraneous cognitive burden, the closely related cognitive burden) for each dimension. (7) Paragraphs, with five alternatives (very high, high, medium, low and very low). Academic achievement test. [36,37].

Statistical analysis of the cognitive load test

Authenticity of the tool:

1- The validity of the arbitrators: The questionnaire of the scale was presented to (6) arbitrators in the specialization of curricula and methods of teaching mathematics in the Department of Mathematics, Educational and Psychological Sciences, in both Al-Mustansiriya University as well as the University of Baghdad in order to assess the validity of each item for the items of the scale in order to measure the cognitive load and to express their observations And their amendments to the paragraphs of the scale and their readiness for implementation, a 98% approval rate was obtained, with some minor linguistic adjustments being made in the wording of the paragraphs.

2- The validity of the construction: The construction validity of this scale was verified by the following methods:

A. Extracting the discriminatory power of the cognitive burden scale items: In order to measure the discriminatory power using the two extreme groups, the cognitive burden scale was applied to the discrimination sample (statistical analysis), which numbered (100) male and female students from the College of Education / Department of Mathematics, after correcting the questionnaires. The order of the answers is ascending and descending, the items of the scale were analyzed using (chi-square), see Table (2):

table(2)

The discriminatory power of the items of the cognitive burden scale in the two-samples method

items	Upper group		Lower group		Calculated T value	Significance
1	3.313	1.465	2.037	1.104	3.671	Yes
2	3.066	1.360	2.481	1.315	3.254	Yes
3	3.616	1.343	2.047	1.312	4.342	Yes
4	3.185	1.466	1.777	1.133	3.466	Yes
5	3.703	1.299	2.592	1.420	2.999	Yes
6	3.740	1.141	2.185	1.277	4.718	Yes
7	3.851	0.847	1.370	0.727	11.549	Yes
8	3.296	1.559	1.740	1.264	4.028	Yes
9	3.814	1.306	1.840	0.965	6.316	Yes
10	3.414	1.1967	1.592	1.097	5.831	Yes
11	3.0740	1.5135	1.962	1.346	2.852	Yes
12	3.148	1.208	1.851	1.112	4.104	Yes
13	3.851	1.238	1.888	1.257	5.781	Yes
14	3.962	1.261	1.896	0.860	7.033	Yes
15	2.925	1.585	1.185	0.474	5.465	Yes
16	3.148	1.432	1.703	1.211	4.003	Yes
17	3.740	0.885	1.481	1.201	7.868	Yes
18	3.814	1.089	1.962	1.065	6.317	Yes
19	3.592	1.394	1.807	0.448	6.334	Yes
20	3.555	1.196	1.329	1.337	6‹447	Yes
21	3.629	1.221	1.066	0.490	10.122	Yes

B. The method of correlation of the degree of the paragraph with the total degree of the cognitive burden scale: It is to obtain the correlation between the degree of each paragraph and the total degree of the scale in general, where the Point-Baserial correlation was used, and it was shown that all the paragraphs are statistically significant, see Table (3)

Table (3)
The values of the correlation coefficients between the paragraph score and the total score of the cognitive burden scale

items	Correlation Coefficient	items	Correlation Coefficient	Significance
1	0.105	12	0.378	Yes
2	0.992	13	0.900	Yes
3	0.866	14	0.290	Yes
4	0.526	15	0.504	Yes
5	0.904	16	0.544	Yes
6	0.588	17	0.054	Yes
7	0.207	18	0.990	Yes
8	0.482	19	0.090	Yes
9	0.248	20	0.195	Yes
10	0.053	21	0.160	Yes
11	0.411			Yes

C. Correlation coefficient between the degree of the paragraph and the total degree of the domain to which it belongs for the cognitive burden scale: The correlation coefficient was found between the degree of each paragraph and the degree of the domain to which it belongs, and it was found that it indicates the internal consistency in the test paragraphs and the table (4) illustrates this.

Table (4)
the correlation coefficients between the paragraph score and the total score of the domain to which it belongs for the cognitive load scale

fields	the essential	the intruder		closely related		Indication level
items	Correlation Coefficient	items	Correlation Coefficient	Items	Correlation Coefficient	0.50
1	0.784	1	0.983	1	0.911	yes
2	0.583	2	0.895	2	0.034	yes
3	0.322	3	0.410	3	0.902	yes
4	0.274	4	0. 013	4	0.713	yes
5	0.475	5	0.503	5	0.105	yes
6	0.713	6	0.140	6	0.353	yes
7	0.394	7	0.232	7	0.015	yes

D. Correlation coefficient between the degree of the domain and the total degree of the cognitive burden scale: The correlation coefficient between the degrees of each domain and the total degree of the scale was adopted by adopting the Pearson correlation coefficient, where it was found that all correlation coefficients are statistically significant ; see Table (5).

Table (5)
the correlation coefficients between the domain degree and the total degree of the cognitive burden scale

the scale	fields	correlation coefficient	indication
cognitive load	the essential	0.024	Yes
	the intruder	0.136	
	closely related	0.290	

The stability of the tool: The stability of the research tool (the cognitive burden scale) was calculated on the members of the previous exploratory sample, which numbered (30) male and female students, in the

Department of Mathematics - College of Education / Al-Mustansiriya University using two methods:
1- The method of re-applying the tool: The stability was calculated after re-applying the cognitive burden scale on the stability sample of (30) male and female students, as the value of the reliability coefficient was extracted, which was found to be equal to (0.8024), and this indicator is good.
2- Alpha Cronbach method: The researchers used the Alpha Cronbach method to calculate the stability of the scale, where the total stability coefficient was (0.8308), which indicates that the scale enjoys a high degree of stability.
Final Application: After the researchers completed the procedures for constructing the cognitive burden scale and verifying its validity and reliability, the scale was applied to the research sample, which amounted to (200) male and female students who were randomly selected from the Mathematics Department.

Statistical analysis of the academic achievement test:

Tool validity: Two types of validity were found as follows:
1- The veracity of the arbitrators:
The test was presented to (6) arbitrators in the field of mathematics and mathematics curricula and methods in the Department of Mathematics, Educational and Psychological Sciences, in both Al-Mustansiriya University as well as the University of Baghdad in order to assess the validity of each of the test items in order to measure academic achievement and to express their observations and modifications to the test items and their readiness For the application, the approval was obtained at 80%, with some minor modifications to the test paragraphs.
2- Structure validity: The construction validity of this test was verified by the following methods:
A. Difficulty factor for paragraphs:
The calculation of the difficulty coefficient for the test items is necessary, as it may delete the items that are easy, as well as the substantive and article items that are difficult, and after the equation for finding the difficulty coefficient was approved, the coefficients were acceptable as the sources refer to them, because they fall within the period (0.20). -0.67), which is the acceptance period. See Table (6).

Table (6)
The difficulty coefficient of the academic achievement test

items	difficulty coefficient	indication	items	difficulty coefficient	indication
1	0.453399	acceptable	16	0.490436	acceptable
2	0.471917	acceptable	17	0.527473	acceptable
3	0.508955	acceptable	18	0.620066	acceptable
4	0.416362	acceptable	19	0.453399	acceptable
5	0.453399	acceptable	20	0.471917	acceptable
6	0.651243	acceptable	21	0.617831	acceptable
7	0.360806	acceptable	22	0.583029	acceptable
8	0.546451	acceptable	23	0.576453	acceptable
9	0.545992	acceptable	24	0.527473	acceptable
10	0.416362	acceptable	25	0.601547	acceptable
11	0.438237	acceptable	26	0.56451	acceptable

12	0.503029	acceptable	27	0.69414	acceptable
13	0.659476	acceptable	28	0.486732	acceptable
14	0.620066	acceptable	29	0.527473	acceptable
15	0.411834	acceptable	30	0.675621	acceptable
			31	0.551660	acceptable

B. Paragraph discrimination strength: The equation that pertains to the discrimination coefficient of the items has been adopted to find the discrimination coefficient for the items. The item is considered acceptable if the proportion of its coefficient of discrimination is (20%) or more, and it is weak if its discrimination is less than this percentage, so it is advised to delete it. Therefore, all test items can be considered acceptable. In distinguishing them, as in Table (7), which shows the discrimination coefficient.

Table (7),
the discriminatory power of the objective paragraphs, 25 items (correction: 0, 1)

items	Coefficient of Excellence	indication	items	Coefficient of Excellence	indication
1	0.2779	Featured	14	0.5110	Featured
2	0.5881	Featured	15	0.2945	Featured
3	0.5015	Featured	16	0.4553	Featured
4	0.4404	Featured	17	0.3145	Featured
5	0.6134	Featured	18	0.4048	Featured
6	0.3990	Featured	19	0.3160	Featured
7	0.4871	Featured	20	0.41173	Featured
8	0.3212	Featured	21	0.2433	Featured
9	0.3001	Featured	22	0.4743	Featured
10	0.6085	Featured	23	0.50343	Featured
11	0.3830	Featured	24	0.6140	Featured
12	0.5345	Featured	25	0.4760	Featured
13	0. 3166	Featured			

Table (8)
the discriminatory power of the academic achievement test for essay paragraphs (correction: 0, 1, 2)

No.	Upper group		Lower group		Calculated t-test	indication
	mean	St. dev.	mean	St. dev.		
1	1.342	0.6012	4.532	0.5817	4.532	Yes
2	1.474	0.7890	5.702	0.4021	5.702	Yes
3	1.885	0.3012	7.8711	0.5981	7.8711	Yes
4	1.2074	0.3019	5.311	0.6120	5.311	Yes
5	1.0337	0.5057	6.740	0.3980	6.740	Yes

6	1.346	0.4126	12.360	0.2561	12.360	Yes

C- Effectiveness of alternatives: the existing alternatives must be camouflaged, that is, an alternative is chosen by the student in a percentage that should not be less than 5% of the students, and the choice of the wrong alternative is usually from the lower group more than the upper group. The effectiveness of the alternatives for the objective paragraphs was found and it was found that the wrong alternatives attracted the students of the lower group more than the upper group, with a percentage of no less than 5% of the total students, and thus all of them are camouflaged. Table (9) shows the effectiveness of the alternatives to the substantive paragraphs:

Table (9)
the effectiveness of false alternatives to the academic achievement test

No.	a	b	c	No.	a	b	C
1	-0.0840	-0.1506		14	-0.07407	-0.14815	
2	-0.14815	-0.2021	-0.1311	15	-0.185-		-0.192
3		-0.1311	-0.14815	16	-0.1311	-0.256	
4	-0.14815	-0.1011	-0.296	17	-0.07407	-0.296	-0.1759
5		-0.18519	-0.14815	18	-0.2412		-0.07407
6	-0.07407	-0.296		19	-0.2966	-0.3413	
7		-0.2212	-0.18519	20		-0.14815	-0.1311
8	-0.14815	-0.25926		21	-0.20222		-0.0800
9	-0.25926	-0.1311		22		-0.14815	-0.18519
10		-0.1475	-0.215	23	-0.18519	-0.1849	-0.2022
11	-0.3453	-0.22222	-0.0717	24		-0.2686	-0.2016
12		-0.1441	-0.2956	25	-0.07407		-0.18519
13	-0.07407	-0.25926	-0.1945				

The stability of the tool: The stability of the research tool, the academic achievement test, was calculated on the members of the previous exploratory sample, which numbered (30) male and female students, in the Department of Mathematics - College of Education / Al-Mustansiriya University using two methods:
1- Retest method: The stability was calculated after re-applying the academic achievement test on the stability sample of (30) male and female students.
2- The method of fixing the correctors:
A. The corrector himself:
To verify the stability of the correction for the article paragraphs, the test paragraphs of the statistical analysis sample were corrected by the researchers, and after a period of time (15) days, the paragraphs were re-corrected, and by adopting the Cooper equation, it was found that the stability of the correction for the corrector with itself is 0.95, as this value is considered acceptable.
B. The debugger with another debugger:
The test was corrected by another debugger in order to ensure the accuracy of the grades given to the students, and based on the same equation, the stability of the correction was found, which is (0.91), which is considered an acceptable value, where the stability of the correction is acceptable if its coefficient is (75%) or more.
Final Application: After completing the procedures for constructing the academic achievement test and verifying its validity and reliability, the scale was applied to the research sample, which amounted to (200) male and female students who were randomly selected from the Mathematics Department.
Statistical means: Pearson correlation coefficient was used to obtain the results

Results

The first objective: to identify the level of cognitive burden among students of the Department of Mathematics, and to achieve it, the arithmetic mean of the research sample scores was extracted on the cognitive burden scale and the hypothetical average. From the tabular T-value at the significance level (0.05) and the degree of freedom (199), and this indicates that the sample members have a cognitive burden, see table (10).

Table (10)
The difference between the arithmetic mean and the hypothetical mean of the CL scale

No.	test Items	hypothetical mean	SMA	St.dev.	t-test value		Significance Level
					calculated	tabular	
200	21	63	69.500	10.505	8.480	1.96	Yes

The second objective: to identify the academic achievement of the students of the Department of Mathematics and to achieve the arithmetic mean of the scores of the research sample was extracted on the academic achievement test for general mathematics information and the hypothetical average reached (18) degrees, and to know the significance of the statistical differences between the arithmetic mean and the hypothetical average, the T-test was used for the sample One, the results showed that the calculated t-value is greater than the tabular value of (1.96) at the significance level (0.05) and the degree of freedom (199), and this indicates that the sample members have an academic achievement in general mathematics information, and Table (11) illustrates.

Table (11)
The calculated and tabular T-value to indicate the difference between the arithmetic mean and the hypothetical mean of the academic achievement test

No.	test items	hypothetical mean	SMA	St.dev.	t-test value		Significance Level
					calculated	tabular	
200	31	18	21.980	8.986	5.720	1.96	Yes

The third objective: To identify the relationship between cognitive burden and academic achievement, and to achieve it, the Pearson correlation coefficient was calculated between the total score of the research sample on the cognitive burden scale and the total score on the achievement test. The value of the correlation

coefficient was (0.4901), and this indicates that There is a positive correlation between the cognitive load and academic achievement, and table (12) illustrates this.

Table (12)
Correlation coefficient between cognitive load and academic achievement

Variables	SMA	St.dev.	correlation coefficient	Significance level
cognitive load	69.500	10.505	0.4901	yes
academic achievement	21.980	8.986		

Conclusion

In light of the findings of the research through data analysis, it was concluded that the individuals of the research sample have a cognitive burden. The mathematical activities, skills and tasks practiced by students of the Department of Mathematics contribute to increasing the cognitive load. The members of the research sample possess comprehensive mathematical knowledge of concepts, skills, principles and problems, which represents their academic achievement in mathematics. The cognitive load is positively correlated with academic achievement.

Recommendations

In light of the results and conclusions reached by the researchers, a special educational environment must be provided, far from any pressures that help security and psychological stability, in order to reduce the cognitive burden of the learner. The possibility of university cadres benefiting from the scale prepared by the two researchers and the results that were reached to identify students who suffer from the cognitive burden in mathematics in order to develop appropriate solutions to address such cases. The use of strategies emanating from the theory of cognitive load in the educational process. The foundations of the theory of cognitive burden, its principles and assumptions must be taken into account when building educational curricula for mathematics for university levels. Establishing training courses and indicative programs on strategies to reduce the cognitive load.

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