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THE EFFICIENCY IN THE COGNITIVE REPRESENTATION OF INFORMATION AMONG THE STUDENTS' ENROLLED IN THE FACULTY OF EDUCATION AT THE UNIVERSITY OF HAIL IN THE LIGHT OF SOME VARIABLES

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ABSTRACT: *The present study aimed to identify the extent of efficiency in the cognitive representation of information among the students' enrolled in the faculty of education at the University of Hail. The study's sample consists from 320 female and male students. The researcher used the cognitive representation scale which was developed by Rajab (2007). It was found that the level of the cognitive representation efficiency is moderate among those students. The efficiency in adopting the feature comparison model is ranked first. The efficiency in adopting the cognitive network modelis ranked second. The efficiency in adopting the spreading activation model is ranked third. It was found that there is a statistically significant difference between the students' cognitive representation efficiency level which can be attributed to gender. The latter difference is for the favor of females. It was found that there is a statistically significant difference between the students' efficiency levels which can be attributed to the academic year. The latter difference is for the favor of fourth year students. It was found that there is a statistically significant difference between the students' efficiency levels which can be attributed to the academic achievement level. The latter difference is for the favor of the students whose academic achievement is excellent.*

KEYWORDS: cognitive, representation, efficiency, information, students, university, Hail,

INTRODUCTION

During the contemporary age, many developments have been made in scientific, technological and information fields. That led to the generation of huge amounts of information. Thus, it became necessary to organize such information. Carrying out such organizations requires receiving, representing, and saving information. It also requires retrieving information when its' needed for handling problems.

Since the second half of the 20th century, psychologists have been providing increasing attention to cognitive processes. It should be noted that many problems are attributed to one's incapability to meet the knowledge requirements.Due to the knowledge explosion andtechnological revolution, numerous major problems have arisen. Thus, researchers must conduct more studies about the way of handling these problems (Salit and Al-Jamal, 2007).

Knowledge-related issues have been receiving increasing attention by the ones who are specialized in cognitive psychology. Cognitive psychology aims at exploring the varioustypes of knowledge that one receives throughout life. It also aims at exploring the processes that are associated with acquisition of information. It also aims at exploring the processes that are associated with saving

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information in the memory and retrieving it. These processes are called (cognitive processes) (Al-Sharqawi, 2003).

The specialists in cognitive psychologyare concerned in exploring the mechanisms of knowledge representation. They are also concerned in exploring the processes through which knowledge is represented and processed. They are also concerned in exploring the way one organizesand re-organizesthe cognitive representations. They are concerned in exploring the extent of harmony between the cognitive representation processes. They are concerned in exploring the way these processes are carried out in an accurate and quick manner. In addition, they are concerned in exploring the way the cognitive representation processes complement one another (Al-Zayat, 1998).

Cognitive representation

The specialists in cognitive psychology are concerned in exploring many areas. Their main concern is represented in exploring the cognitive representation. They aim atexploring the way events are represented in the human mind (Reynolds & Flagg, 1983). Many psychologists definecognitive representationas an activity through which one generates knowledge or leads one to produce new concrete objects(Denis, and Greembaum, 1991).

Piaget (1963)believes that cognitive developmentoccurs through shaping the cognitive representations.He also believes that cognitive representationrefers to one's information database that is used for interpreting the events that occur in the surrounding environment. He believes that there are general abstract representationsthrough which one can arrange cognitive actions. He suggests that eachrepresentation carries out specific functions. Such functions include: identifying the meaning of things. Piaget (1963) distinguishes between two types of representation. The first type is the non-cognitive representation. Such representations develop during the early years of one's life.They are based on instinctive reactions. They start to change slowly once one is starting to adapt himselfwith the surrounding environment.In other words,one'sinstinctive reactions shall turn into target-oriented behaviors throughout life. The second type is the cognitive representation. One starts to form cognitive representationsonce he's capable to use symbols. Being capable to use symbols indicates that one shall be capable to carry outcognitive processessoon. Being capable to carry out such processes shall enable one to build cognitive structures(Piaget, 1963).

Piagetbelieves that childrenseek gainingmore knowledge constantly. That shall enable children to carry out cognitive representation processes. In other words, Piaget believes that children have an intrinsic motivation for gaining more knowledge. He also suggests that some environmental and biological factors can significantly affect cognitive growth. However, he believes that the intrinsic motivation is the most influential factor among those factors (Tomic, 1996).

The specialists in cognitive psychology believe that the cognitive representation of information is considered one of the most significant expressions in cognitive psychology. They also suggest that most of the scientific disciplines are based on the processes of the cognitive representation of information in one's memory (Sian et al., 2004). It should be noted that the cognitive representation of information shall enable individuals to develop cognitive maps for the elements of a problem. Such representation shall enable individuals to establish relationships between the elements and

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goals of a problem. It shall enable individuals to comprehend problems and think about theirsolutions (Al-Khudari, 2001).

The cognitive representation of information is a significant complexprocess. It involves several simple cognitive sub-processes. These sub-processes can be represented in the form of a hierarchy. This hierarchy consists from several levels. In this hierarchy, saving and storing information represent the base of the hierarchical structure. Classification and connection of information are placed in the second level of the hierarchy. Aligning new information in the memory are placed in the third level of the hierarchy. The generation or derivation of information are placed in the fourth level of the hierarchy. The fifth level of the hierarchy is represented in utilizing and employing information in an effective and productive manner for meeting specific purposes. The sixth level of the hierarchy is represented in self-assessment. It's considered the highest level in the hierarchy. It refers to carrying out alignment, classification or derivation processes based on the information available in the memory and the errors that have been detected through employing information (Mohammad, 2008).

Piaget's theory is considered one of the most important theories that addresses thecognitive representation of information. That's because it is the theory that has addressed cognitive and mental growth the most (Al-Musawi and Majli, 2016). Piaget suggests that the cognitive representation of information is a cognitive process that enables the learner to transform the newly recognized issues, or stimulating event into behavioral models or schemes. Through such representation, the learners integrates the recently acquired expertise with the old one in order to form new concepts.

A learner may be introduced to a newstimulus that he can't represent because he doesn't have relevant information. In such a case, the learner shall develop a new concept in order for the stimulus to fall under. The learner may be introduced to a stimulus that is related to a concept that he already knows. In such a case, Piaget suggests that the processes of alignment and representation shall be conducted (Al-Shahmani, 2015).

Solo (2000) suggests that cognitive representation is a process that consists of several simplecognitive processes. These processes can be represented in a hierarchy. Saving and storing information are placed in the base of this hierarchy. The latter processes involvesaving information in their preliminary form. Classification and connection of information are placed on the secondlevel of the hierarchy. These processes involve distributing information in a manner that makes it easy to retrieve. Achieving alignment between the old and new information is place at the third level of the hierarchy. The fourth level includes retrieving information and employing itin the relevantcontext after processing it. Solo (2000) suggests that cognitive representation is an essential processes for learning.

Al-Zayat (2001) suggests that there are cognitive representation can be classified into three types based on efficiency. The firsttype is the superficialcognitive representation. It involves minor processing of information and retrieving it for a temporary period. It also involvesretrieving information in their preliminary form. Through the superficial cognitive representation, the information is slightly processed. The second typeis the moderate cognitive representation. It may include comprehending, and processing information through making connections, or relationships between information. It may include comprehending, and processing information through eliciting

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meaning from the newly acquired information. Through the moderate cognitive representation, the information is stored for a temporary period. The third type is the deep (effective) cognitive representation. It's based on comprehending information and eliciting meaning from it. Through the latter type, the information is stored for a long period of time.

Many studies were conducted about cognitive representation and its relationship with other variables. Such studies include the one conducted by Lovett& Schunn (1999). The latter researchers aimed to explore the relationship between the cognitive representation of information and choosing the right problem solving strategy. The sample consists from 58 female and male university students. The latter researchers used a cognitive representation scale and a problemsolving scale. They found that connecting concepts or elements with one another –as a method for the cognitive representation- shall lead to having a discrepancy in the cognitive representation. Such a discrepancy shall negatively affect the quality of one's choice in terms of the problem solving strategy.

Mohammad (2008) aimed to explore the extent of efficiency in the cognitive representation of information based on Biggs's model. The sample consists from 200 female and male students. The latter researcher used a scale for measuring the latter efficiency. It was found that there is adifference between the scores of the students which can be attributed to the learning approach. The latter difference is for the favor of the ones who adopt a superficial learning approach.

Yang & Hung (2008) aimed to identify the extent of thecognitive representation efficiency of the students enrolled in the Taiwanese collegeswhile studying Quranic verses through the web. The study's sample consists from 92 students enrolled in a Taiwanese university. The latter researchers used a cognitive representation survey. It was found that professional readers show a higher efficiency level than other students. It was found that there's a significant correlation between using a technology-based teaching method and the cognitive representation efficiency level.

Al-Khraibi (2009) aimed to explore the learning patterns of secondary stage students. He also aimed to explore the relationship between these patterns and the cognitive representation efficiency. The sample consists from 446 female and male students. The latter researcher used a cognitive representation efficiency scale and a scale for exploring the teaching and learning patterns. The latter scale was developed by Salah Murad (1988). It was found that there isn't any statistically significant difference between the students' cognitive representation efficiency which can be attributed to gender. It was found that there is a statistically significant difference between the students' cognitive representation levels which can be attributed to thethinking and learning patterns.

Ding et al. (2011) aimed to identify the impact of gender, and the learning performance constraints on the students' cognitive representation efficiencylevel in Shanghai in China. The sample consists from 141 female and male students. The respondents were trained for two weeks through usingan electronic cooperative learning approach. The training session consists from 40 minutes. After that, the forms of a problem solving test were distributed to them. After analyzing data, it was found that there's a significant correlation between the students' cognitive representation efficiency level and adopting the cooperative learning approach.

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Al-Qaisi and Abed Al-Khaleq (2012) aimed to identify the cognitive representation efficiency of the 4thprepatory grade students. They also aimed to identify whether there are statistically significant differences between the students' efficiency levels which can be attributed to gender, and major. They also aimed to identify the relationship between the latter efficiency and the teaching and learning methods. The sample consists from 200 female and male students. The latter researchers used a cognitive representation scale. They used Shemk's scale for learning methods. They used Sternberg's scale for the thinking methods. It was found that the respondents' cognitive representation efficiency level is high. It was found that there is a statistically significant difference between the students'cognitive representation efficiency levels which can be attributed to gender. The latter difference is for the favor of females. It was found that there isn't any statistically significant difference between the students' cognitive representation efficiency levels which can be attributed to major. It was found that there is a correlation between the cognitive representation efficiency and the learning and thinking methods.

Al-Fanharawi (2012) aimed to identify the relationship between the academic self-motivation and the cognitive representation efficiency. She also aimed to identify whether there are statistically significant differences between the students' efficiency levels which can be attributed to gender or academic stream (literary or scientific stream). She used a cognitive representation scale and an academic self-motivation scale. The sample consists from 450 female and malestudents in Syria. They were selected from the fourth preparatory grade. It was found that there is a positive significant correlation between the academic self-motivation and the cognitive representation efficiency. It was found that there is a statistically significant difference between the students' cognitive representation efficiency levels which can be attributed to gender. The latter difference is for the favor of males. It was found that there is a statistically significant difference between the students' cognitive representation efficiency levels which can be attributed to the academic stream. The latter difference is for the favor of the students enrolled in the scientific stream.

Al-Ka'bi and Yousef (2015)aimed to identify the relationship between the cognitive representation efficiency and meta-memory capability among university students. The sample consists from 200 female and male students. The researchers used the cognitive representation scale which was developed by (Ghanem, 2011). They used the meta-memory capability scale which was developed by Brewer and British (2002). It was found that the respondents have a good cognitive representation efficiency level. It was found that the respondents are aware about the way in which their memory operates. It was found that there is a positive significant correlation between the cognitive representation efficiency and the meta-memory capability.

Al-Shahmani (2016) aimed to identify theextent of efficiency in thecognitive representation of informationamong the fifth preparatory grade students in Iraq. He also aimed to identify the extent of using the receptive-comprehensive cognitive method by students. He used a cognitive representation efficiency scale. The latter scale was developed by Johny (2012). The sample consists from 372 female and male students. They were selected from Waset, Iraq. It was found that the cognitive representation efficiency level is high. It was found that there isn't any statistically significant difference between the students' efficiency levels which can be attributed to gender. It was found that there is a statistically significant difference between the students' cognitive representation efficiency levels which can be attributed to the academic stream. The latter difference is for the favor of the students enrolled in the scientific stream.It was found that

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there is a statistically significant difference between the students' extent of using the receptive-comprehensive cognitive methods which can be attributed to gender for the favor of males. It was found that there isn't any statistically significant difference between the students'extent of using the receptive-comprehensive cognitive methods which can be attributed toacademic major. It was found that there is a negative correlation between the efficiency in the cognitive representation of information and the extent of using the receptive-comprehensive cognitive method by students.

Al-Musawi and Majli (2016) aimed to measure the cognitive representation efficiency levels among university students. The sample consists from 500 female and male students enrolled in Al-Qadeseya University. In order to meet the study's goals, a scale was used for measuring the cognitive representation efficiency levels. It was found that there is a statistically significant difference between the students' efficiency levels which can be attributed to gender. The latter difference is for the favor of females.It was found that there is a statistically significant difference between the students' cognitive representation efficiency levels which can be attributed to the academic stream. The latter difference is for the favor of the students enrolled in the scientific stream.

Amr (2018) aimed to explore the relationship between the extent of comprehending statistics and probability-related concepts, and the cognitive representation efficiency. He also aimed to measure the abstract thinking capacity of 11^{th} grade students in Khalil, Palestine. The sample consists from 680 female and male students. The researcher used a scale for measuring the extent of comprehending statistics and probability-related concepts. Another scale was also used measuring thecognitive representation efficiency. A test was used for measuring the abstract thinking capacity. It was found that the extent of comprehending statistics and probability-related concepts is low. The respondents showed a good the cognitive representation efficiency level. It was found that there is a statistically significant difference between the students' efficiency levels which can be attributed to gender. The latter difference is for the favor of males. It was found that there is a statistically significant difference between the students' abstract thinking capacity levels which can be attributed to the academic stream. The latter difference is for the favor of the students enrolled in the scientific stream.

Abed Al-Raheem and Fawaz (2018) aimed to explore the relationship between emotional creativity and mindfulness from one hand and the cognitive representation efficiency from another hand. The sample consists from 360 female and males students who are enrolled in the faculty of education, at Sohaj University. The latter researchers used an emotional creativity scale which was developed by Avrilland translated by Al-Menshar. They used a mindfulness scale which was developed by Bear et al. and translated by Al-Buhairy et al. They used a cognitive representation efficiency scale which was developed by them. It was found that there's a significant correlation between emotional creativity and mindfulness from one hand and the cognitive representation efficiency from another hand.It was found that there is a statistically significant difference between the students' cognitive representation efficiency levels which can be attributed to the academic achievement. The latter difference is for the favor of the students who show an excellent academic achievement level. It was found that there is a statistically significant difference between the students' emotional creativity levels which can be attributed to the academic achievement. The latter difference is for the favor of the students who show an excellent academic achievement level. It was found that mindfulness can significantly affect thecognitive representation efficiencyof the

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students who show an excellent academic achievement level. It was found that emotional creativity can significantly affect the quality of the cognitive outcomes.

Statement of the Problem& the Study's Questions:

In the light of the aforementioned, the present study aimed to identify the extent of efficiency in the cognitive representation of information among the students' enrolled in the faculty of education at the University of Hail. To be specific, the study's problem can be represented in the following main question:

What is the extent of efficiency in the cognitive representation of information among the students' enrolled in the faculty of education at the University of Hail?

The following sub-questions are derived from the latter question:

Q.1 What is the extent of efficiency in the cognitive representation of information among the students' enrolled in the faculty of education at the University of Hail?

Q.2Is there any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to gender?

Q.3 Is there any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to the academic year?

Q.4 Is there any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to the academic achievement?

The Study's Significance:

The present study is significant due to the following reasons:

1. The present studyprovides theoretical knowledge about the extent of efficiency in the cognitive representation of information among the students' enrolled in the faculty of education at the University of Hail
2. The present study provides knowledge about such efficiency. It also provides recommendations related to such efficiency.

The Study's Objectives:

The present study aimed to:

1- Identify the extent of efficiency in the cognitive representation of information among the students' enrolled in the faculty of education at the University of Hail
2- Identify whether there's any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to gender
3- Identify whether there's any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to
4- Identify whether there's any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed toacademic year

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5- Identify whether there's any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to academic achievement

The Study's Limits:

The study's limits are:

1. Human limits: The present study is limited to a sample selected from the faculty of education at the University of Hail
2. Temporal limits: The present study was conducted during the second semester of the academic year (2017-2018).
3. Spatial limits: The present study wasconducted at the faculty of education at the University of Hail.

Definition of Terms:

Cognitive representation:It refers to the process of transforming stimuli into schemes or behavioral patterns(Piaget, 1963). It refers to the process of eliciting information from the sensory experiences. It also involves decoding and organizing such information and storing it in the memory (Sternberg,1992).It refers to a set of elements that constitute one's cognitive structure. Such elements include: expertise, knowledge, and skills (Sun, 2008).
It refers to the total score that the respondents gets in the cognitive representation scale (the operational definition).

The Study's Procedures:

The study's sample:

The study's population is represented in all the students who were enrolled in the faculty of education at the University of Hail during the second semester of the academic year (2017-2018). The study's sample consists from 320 students who were selected from the study's population. Those students were selected through usingthe simple random sampling method.

Table (1): The distribution of the study's sample in accordance with gender, academic achievement, and academic year

Variable	Level	Frequency	Percentage
Gender	Male	170	53.1
	Female	150	46.9
Major	Psychology	110	34.4
	Special education	100	31.3
	Islamic education	110	34.4
Academic achievement level	Excellent	35	10.9
	Very good	70	21.9
	Good	150	46.9
	Accepted	65	20.3
Academic year	First	70	21.9
	Second	75	23.4
	Third	90	28.1
	Fourth	85	26.6
Total		320	100.0

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The study's instruments:

The researcher used a scale for measuring the students' efficiency in the cognitive representation of information. The latter scale was developed by Rajab (2007). It includes30 items that address with three models. These models are: the cognitive network model (items No. 1-10), the spreading activation mode (items No. 11-20), and andthe feature comparison model (items No. 21- 30). The multiple choice answers are: (it applies, it applies a little, &it doesn't apply).

The latter scale was sent to ten experts. These experts are faculty members at the faculty of education at the University of Hail. They were asked to assess the scale in terms of language clarity and appropriateness to the local environment. 80% of the experts suggest that the scale is appropriate to the local environment. The researcher measured the validity and reliability of the scale. Internal consistency was measured for checking the scale's validity

Internal consistency:

In order to measure internal consistency, the values of Pearson correlation coefficient were calculated. They are presented in table (2)

Table (2): The value of Pearson correlation coefficient of each statement

Model	Item	The correlation coefficient value	Item	The correlation coefficient value
The cognitive network model	1	**0.798	6	**0.555
	2	**0.587	7	**0.711
	3	**0.516	8	**0.675
	4	**0.694	9	**0.796
	5	**0.531	10	**0.522
The spreading activation mode	11	**0.523	16	**0.649
	12	**0.511	17	**0.674
	13	**0.762	18	**0.532
	14	**0.577	19	**0.611
	15	**0.621	20	**0.744
The feature comparison model	21	**0.786	26	**0.747
	22	**0.538	27	**0.638
	23	**0.641	28	**0.599
	24	**0.567	29	**0.624
	25	**0.724	30	**0.582

(*): This symbol means that the value is statistically significant at the statistical significance level of a=0.01

Based on table (2), all the values of correlation coefficient are positive andstatistically significantat the statistical significance level of a=0.01.

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Table (3): The values of thecorrelation coefficient between each model and total score

Model	The value of the Cronbach alpha coefficient
The cognitive network model	0.752
The spreading activation mode	0.891
The feature comparison model	0.746

Based on table (3), the values of the correlation coefficient between the models and total score are positive and statistically significant at the statistical significance level of a=0.01. That means that all the items are valid and capable of measuring the variables that they were set to measure.

Reliability

The values of Cronbach alpha coefficient were calculated to measure the reliability of the scale.

Table (4): The values of the reliability coefficient of the models and the total reliability coefficient value

Model	The value of the Cronbach alpha coefficient
The cognitive network model	0.851
The spreading activation mode	0.786
The feature comparison model	0.843
Total	0.902

Table (4)presents the values of the Cronbach alpha coefficient of the models. It also presents the total Cronbach alpha coefficient value. These values are within the range of 0.786- 0.902. All these values are high. Thus, the scale is highly reliable.

The study's results:

The results related to the first question:

Q.1 What's the extent of efficiency in the cognitive representation of information among the students' enrolled in the faculty of education at the University of Hail?

The cognitive network model

In order to answer the first question, means and standard deviations were calculated to identify the students' cognitive representation efficiency levelwhen using the cognitive network model. Ranks were identified too.

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Table (5): Means and standard deviations related to identify the students' cognitive representation efficiency level when using the cognitive network model

No.	Statement	Arithmetic mean	Standard deviation	Level	Rank
10	I pay attention to the details mentioned because it facilitates the retrieval of information	2.27	0.679	Moderate	1
8	I memorize the information that I studywithout organizing nor re-arranging it	2.24	0.662	Moderate	2
6	I seek arranging and organizing information in all courses	2.22	0.707	Moderate	3
5	I seek arranging and organizing information because that saves time	2.20	0.723	Moderate	4
7	I seek organizing information and concepts based on their importancewith starting from the most important ones	2.20	0.687	Moderate	5
3	I seek organizing information in levels because that makes information easy to comprehend	2.19	0.736	Moderate	6
1	I draw charts, and schematic diagrams when seeking tounderstand subject.	2.18	0.672	Moderate	7
4	I arrange information in my mind based on their importance in order for me to comprehend them	2.18	0.683	Moderate	8
2	I deal with every piece of information as being independent	2.12	0.698	Moderate	9
9	I organize information through perceiving itfrom a holistic perspective	1.63	0.584	Low	10
	Total	2.14	0.395	Moderate	

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Table (5) presents the means related to the cognitive network model. These means are within the range of 1.63- 2.27. Most of the means are moderate.The mean of statement 10 is 2.27. It's ranked first. The latter statement states the following (I pay attention to the details mentioned because it facilitates the retrieval of information). The mean of statement 9 is1.63. It's ranked last. The latter statement states the following: (I organize information through perceiving it from a holistic perspective).

The total mean is 2.14 which is moderate. The means that the students' cognitive representation efficiency levelis moderate when using the cognitive network model

Table (6) presents the criteria used for classifying means.

Range	Level
2.34 or more	High
1.67- lessthan 2.34	Moderate
Less than 1.67	Low

The spreading activation model

Means and standard deviations were calculated to identify the students' cognitive representation efficiency level when using the spreading activation model. Ranks were identified too.

Table (7): Means and standard deviations related to identify the students' cognitive representation efficiency levelwhen using the spreading activation model.

No.	Statement	Arithmetic mean	Standard deviation	Level	Rank
18	I remember and retrieve information through connecting concepts with each other.	2.30	0.732	Moderate	1
13	I connect the theoretical aspect with the practical aspect when addressing various subjects	2.24	0.788	Moderate	2
14	I deal with every piece of information as being part of a series	2.20	0.741	Moderate	3
11	I can easily remember the pieces of information when connecting them with one another	2.15	0.706	Moderate	4
15	I use information for perceiving the subject from a holistic view	2.12	0.740	Moderate	5
17	I find a difficulty in finding linksthat connect the subjects I study with one another	2.12	0.722	Moderate	6
16	It is easier for me to retrieve information when a related subject is mentioned	2.09	0.748	Moderate	7
19	I classify the graphs and images that I study. Then, I link them with one another	2.06	0.732	Moderate	8
20	I feel that the pieces of information that I study are connected with one another	1.99	0.719	Moderate	9
12	I perceive the pieces of information that I study as complementing one another.	1.92	0.766	Moderate	10
	Total	2.12	0.414	Moderate	

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Table (7) shows the means related to the spreading activation model. These means are within the range of (1.92 – 2.30). All the means are moderate. Statement 18 shows the highest mean which is 2.30. It suggests the following (I remember and retrieve information through connecting concepts with each other). However, statement 12 shows the lowest mean which is 1.92. It suggests the following: (I perceive the pieces of information that I study as complementing one another).

The total mean is 2.12 which is moderate. The means that the students' cognitive representation efficiency level is moderate when using the spreading activation model

The feature comparison model

Means and standard deviations were calculated to identify the students' cognitive representation efficiency levelwhen using the feature comparison model. Ranks were identified too.

Table (8) Means and standard deviations related to identify the students' cognitive representation efficiency levelwhen using the feature comparison model

No.	Statement	Arithmetic mean	Standard deviation	Level	Rank
22	I can learn better through conducting a comparison between the subjects	2.43	0.678	High	1
25	I feel that conducting a comparison between the subjects that I learn about shall facilitate the process of learning	2.28	0.643	Moderate	2
30	I use diagrams and lines when conducting a comparison between the pieces of information that I learn	2.28	0.643	Moderate	3
21	I pay attention to the details that are mentioned while tacklingthe subject	2.21	0.666	Moderate	4
26	I process the information that I learn through identifying the direct relationships between the concepts	2.20	0.723	Moderate	5
23	I use diagrams and images for conducting a comparison between the pieces of information	2.15	0.775	Moderate	6
27	I transform information into diagrams	2.15	0.706	Moderate	7
29	I conduct a comparison between information and thoughts after discussing them	2.12	0.722	Moderate	8
28	I seek identifying the features of the concepts when learning	2.09	0.748	Moderate	9
24	I conduct a comparison between the pieces of information that I have just learnt with the old ones	2.01	0.730	Moderate	10
	Total	2.19	0.351	Moderate	

Table (8) shows the means that are related to the feature comparison model. They are within the range of (2.01 - 2.43). Most of the means are moderate. Statement 22 shows the highest mean which is 2.43. The latter statement states the following: (I can learn better through conducting a comparison between the subjects).However, statement 24 shows the lowest mean which is 2.01. It suggests the following: (I conduct a comparison between the pieces of information that I have just learnt with the old ones).

The total mean is 2.19 which is moderate. The means that the students' cognitive representation efficiency level is moderate when using the feature comparison model

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Table (9): Means and standard deviations of the students' efficiency in the cognitive representation of information when using the three models

Model	Mean	Standard deviation	Level	Rank
The feature comparison model	2.19	0.351	Moderate	1
The cognitive network model	2.14	0.395	High	2
The spreading activation mode	2.12	0.414	Moderate	3
Total	2.15	0.326	Moderate	

Table (9) shows the means and standard deviations of the extent of the students' efficiency in the cognitive representation of information when using the three models jointly.The feature comparison model is ranked first. Its mean is 2.19. The cognitive network model is ranked second. Its mean is 2.14. The spreading activation model is ranked third.Its mean is 2.12. The total mean is 2.15. That means that the extent of thestudents' efficiency in the cognitive representation of information is moderate when using the three models jointly.

The researcher attributes this result to the nature of the university education. For instance, through receiving such education, students shall become more aware about the nature of the curricula. That shall enable students to connect the old information with the new one. It shall enable them to reach conclusion. Through receiving such education, students shall be introduced to the world of information more than before. They shall pay more attention to the advice and guidelines they hear. That shall enable them to represent information better than before.

The feature comparison model is ranked first. That is because students become better learners when they conduct a comparison between various subject and use diagrams for making such a comparison. This result is consistent with the results concluded by Al-Ka'bi and Yousef (2015), and Amr (2018). However, it's inconsistent with the results concluded by Al-Qaisi and Abed Al-Khaleq (2012).

Results related to the second question:

Q.2 Is there any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to gender?

In order to answer the second question, the t-test for independent samples was conducted. The results of the latter test are presented in table (10)

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Table (10): The resultsof the t-test for independent samplesto identify whether there is any statistically significant difference between the students' cognitive representation efficiency levels which can be attributed to gender

Model	Gender	Frequency	Mean	Std. deviation	T value	Degree of freedom	Sig
The cognitive network model	Male	170	2.06	0.366	3.915-	318	0.000
	Female	150	2.23	0.409			
The spreading activation mode	Male	170	2.03	0.402	4.035-	318	0.000
	Female	150	2.22	0.408			
The feature comparison model	Male	170	2.12	0.350	4.023-	318	0.000
	Female	150	2.27	0.335			
Total	Male	170	2.07	0.300	4.779-	318	0.000
	Female	150	2.24	0.333			

Based on table (10), the statistical significance values are less than 0.05. Thus, there is a statistically significant difference between the students' cognitive representation efficiency levelswhich can be attributed to gender. The latter difference is for the favor of females. Thus, females in the faculty of education at the University of Hail show a higher efficiency in the cognitive representation of information than males.

This result is attributed to the fact that females are more organized than males. They are more capable than males to focus and invest their time. They're more capable to process information than males through finding the links between concepts and paying attention to the details. This result is also attributed to the fact that females in Saudi Arabia spend most of their time at home due to dominant culture in society. Thus, that provides females with more time to study through using special methods for understanding the material and developing knowledge about it. As for males in Saudi Arabia, they spend most of their time outside their homes. That shall negatively affect the time they devote for studying. This result is consistent with the results concluded byAl-Musawi and Majli (2016). However, it's inconsistent with the results concluded by Al-Khraibi (2009) and Al-Fanharawi (2012).

Results related to the third question

Q.3 Is there any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to the academic year?

In order to answer the third question, means and standard deviations are calculated. They are presented in table (11).

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Table (11): Means and standard deviationsof the students' efficiency in accordance with the academic year

Model	Academic year	Frequency	Mean	Standard deviations
The cognitive network model	First	70	2.06	0.423
	Second	75	2.09	0.371
	Third	90	2.07	0.331
	Fourth	85	2.32	0.404
The spreading activation mode	First	70	2.15	0.370
	Second	75	2.12	0.392
	Third	90	2.00	0.381
	Fourth	85	2.21	0.477
The feature comparison model	First	70	2.09	0.346
	Second	75	2.23	0.352
	Third	90	2.12	0.323
	Fourth	85	2.32	0.341
Total	First	70	2.10	0.332
	Second	75	2.15	0.308
	Third	90	2.06	0.282
	Fourth	85	2.28	0.344

Analysis of variance (ANOVA) was conducted to identify whether these differences are statistically significant or not. The results of ANOVA are presented in table (12)

Table (12): The results of the analysis of variance to identify whether the academic year-related differences are statistically significant or not

Model	Source of variance	Sum of squares	Degree of freedom	Mean of squares	F value	Sig
The cognitive network model	Between groups	3.910	3	1.303	8.960	0.000
	Within groups	45.969	316	0.145		
	Total	49.879	319			
The spreading activation mode	Between groups	1.991	3	0.664	3.973	0.008
	Within groups	52.784	316	0.167		
	Total	54.775	319			
The feature comparison model	Between groups	2.752	3	0.917	7.938	0.000
	Within groups	36.523	316	0.116		
	Total	39.276	319			
Total	Between groups	2.374	3	0.791	7.911	0.000
	Within groups	31.608	316	0.100		
	Total	33.982	319			

Based on table (12), the statistical significance values are less than 0.05. Thus, there is a statistically significant difference between the students' cognitive representation efficiency level which can be attributed to the academic year. In order to identify the ones whom the difference is

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in favor for, the least significant difference (LSD) test was conducted. The results of the latter test are presented in table (13)

Table (13): The results of the least significant difference (LSD) to identify the ones whom the academic year-related difference is in favor for

Model	Academic year	Mean	Second	Third	Fourth
The cognitive network model and the spreading activation mode	First	2.06			*
	Second	2.09			*
	Third	2.07			*
	Fourth	2.32	*	*	
The feature comparison model	First	2.15			*
	Second	2.12			*
	Third	2.00			*
	Fourth	2.21	*	*	
Total	First	2.09			*
	Second	2.23			*
	Third	2.12			*
	Fourth	2.32	*	*	
	First	2.10			*
	Second	2.15			*
	Third	2.06			*
	Fourth	2.28	*	*	

(*): This symbol means that the value is statistically significant

Based on table (13),the statistical significance values are less than 0.05. Thus, there are statistically significant differences between the students' efficiency levels in the cognitive representation of information in all the models which can be attributed to the academic year. The latter difference is for the favor of the fourth year students. That means that fourth year students have higher efficiency levels in the cognitive representation of information than others. This result is attributed to the fact that the cognitive capabilities of fourth year students are more developed than others. That's because students' develop academically through receiving the university education. It's also attributed to the fact that fourth year students' aspirationsbecome more realistic. In addition, their perceptions for the future became more mature. This result is consistent with the results concluded byAl-Musawi and Majli (2016).

Results related to the fourth question:

Q.4 Is there any statistically significant difference between the students' efficiency levels in the cognitive representation of information which can be attributed to the academic achievement?

In order to answer the fourth question, means and standard deviations are calculated. They are presented in table (14).

Table (14): Means and standard deviations of the students' efficiency in accordance with the academic achievement

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Model	Academic achievement level	Frequency	Mean	Standard deviations
The cognitive network model	Excellent	35	2.68	0.338
	Very good	70	2.15	0.387
	Good	150	2.03	0.342
	Average	65	2.10	0.304
The spreading activation mode	Excellent	35	2.68	0.325
	Very good	70	2.17	0.379
	Good	150	2.04	0.346
	Average	65	1.94	0.378
The feature comparison model	Excellent	35	2.59	0.341
	Very good	70	2.19	0.360
	Good	150	2.12	0.329
	Average	65	2.14	0.245
Total	Excellent	35	2.65	0.303
	Very good	70	2.17	0.332
	Good	150	2.06	0.270
	Average	65	2.06	0.174

Analysis of variance (ANOVA) was conducted to identify whether these differences are statistically significant or not. The results of ANOVA are presented in table (14)

Table (15): The results of the analysis of varianceto identify whether the academic achievement - related differences are statistically significant or not

Model	Source of variance	Sum of squares	Degree of freedom	Mean of squares	F value	Sig
The cognitive network model	Between groups	12.317	3	4.106	34.542	0.000
	Within groups	37.561	316	0.119		
	Total	49.879	319			
The spreading activation mode	Between groups	14.336	3	4.779	37.341	0.000
	Within groups	40.439	316	0.128		
	Total	54.775	319			
The feature comparison model	Between groups	6.394	3	2.131	20.484	0.000
	Within groups	32.881	316	0.104		
	Total	39.276	319			
Total	Between groups	10.459	3	3.486	46.831	0.000
	Within groups	23.524	316	0.074		
	Total	33.982	319			

Based on table (15), the statistical significance values are less than 0.05. Thus, there is a statistically significant difference between the students' cognitive representation efficiency level which can be attributed to the academic achievement. In order to identify the ones whom the difference is in favor for, the least significant difference (LSD) test was conducted.

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The results of the latter test are presented in table (16).

Table (16): The results of the least significant difference (LSD) to identify the ones whom the academic achievement-related difference is in favor for

Model	Academic achievement level	Mean	Very good	Good	Average
The cognitive network model and the spreading activation mode	Excellent	2.68	*	*	*
	Very good	2.15			
	Good	2.03			
	Average	2.10			
The feature comparison model	Excellent	2.68	*	*	*
	Very good	2.17			
	Good	2.04			
	Average	1.94			
Total	Excellent	2.59	*	*	*
	Very good	2.19			
	Good	2.12			
	Average	2.14			
	Excellent	2.65	*	*	*
	Very good	2.17			
	Good	2.06			
	Average	2.06			

(*): This symbol means that the value is statistically significant

Based on table (16), the statistical significance values are less than 0.05. Thus, there are statistically significant differences between the students' cognitive representation efficiency levels which can be attributed to the academic achievement. The latter differences are for the favor of the ones who show an excellent academic achievement level. Thus, the students who showan excellent academic achievement level show a cognitive representation efficiency level that is higher than others.

This result is attributed to the fact that the students who show an excellent academic achievement level are more capable than others to concentrate. Such capability can significantly affect the students' efficiency in the cognitive representation of information. In addition, this result is attributed to the fact that those students are more capable than others to find links between events. Having the latter capability shall enable students to benefit from experiences and utilize them during the present and the future. That shall positively affect their efficiency in the cognitive representation of information. As for the students with average GPA, they seek finding a link between events and information in order to elicit and classify new information and connect it with previous information. This result is in agreement with the results concluded by Abed Al-Raheem and Fawaz (2018).

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Recommendations:

The researcher recommends:

1- Developing curricula in a manner that participates in raising the students' efficiency in the cognitive representation of information
2- Conducting more studies for identifying the impact of some variables – such as: problem solving, thinking, and decision making skills and intelligence level – on theextent of students' efficiency in the cognitive representation of information
3- Developingeducational and training programs for raising the students' efficiency in the cognitive representation of information

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