

## The Relationship Between the Development of Cognitive Symbolic Representation and Academic Achievement Among Baccalaureate Students During Physical Education and Sports Classes: A Field Study in Some High Schools in the State of Annaba, Algeria

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### Abstract:

Developing of the cognitive symbolic representation ( cognitive side ) during the physical education and sports class is one of the professor's goals according to Bloom's classification which is approved in the curriculum and academic subject within educational institutions concerned with the academic achievement of learners, especially the secondary school ( baccalaureate students).

This field study aimed to determine the relationship between the development of cognitive symbolic representation and academic achievement among baccalaureate students during the physical education and sports class. By relying on the descriptive approach and selecting the sample in a cluster (70 students) from secondary schools in different provinces, the researchers used a collected data as the cognitive symbolic representation's test, Joy Paul Guilford and Paul Christensen, translated and modified by Dr. Boutoutane Hadjer. Also about the academic achievement It was linked to the students' baccalaureate degree average. In order to answer the two proposed hypotheses, (there is a strong positive relationship correlation between the two variables).

The results of this study led to confirm the hypotheses, It means that there is a strong positive relationship between the development of cognitive symbolic representation and academic achievement among baccalaureate students during the physical education and sports class.

**Keywords:** cognitive symbolic representation - academic achievement - physical education and sports class - baccalaureate students.

**Introduction:**

Information representation is fundamental to all forms of human cognition. Information derived from sensory experiences is encoded and linked to objects stored in the brain. One of the challenges we face when communicating is that we do not identically represent the world. What you see, hear, smell, taste, and feel is different from what I experience and represent in my memory. What I experience and store in my memory does not perfectly match what you experience<sup>1</sup>.

The same is true for academic achievement during student learning. It is a non-uniform process for each student. Each student has unique brain cells and characteristics that affect how they receive, process, and store information.

Academic achievement is not simply about acquiring knowledge in various subjects. It is primarily about how that knowledge is stored, or rather, mentally represented in the multiple and diverse brain cells, each with its function. The learner must be able to retrieve this information when needed and use it in the shortest possible time correctly and appropriately.

Physical education and sports have a greater role in this than other subjects. They are unique in that they develop the learner in various aspects, including the physical, cognitive, emotional, and social. Specifically, they develop lower and higher cognitive processes by creating a problem situation during a learning situation. This situation stimulates the learner's previous experiences (encoded and stored in their motor record) to retrieve and modify them to fit the situation in a very short time, taking into account the individual differences between students. The learner then encodes and stores the newly acquired experience.

It is important to note that the various processes performed by the billions of cells and synapses are interconnected by chemical signals that mediate information processing from the molecular to the cognitive level. Neurons produce and release molecules called neurotransmitters and growth factors or hormones. These molecules are sent from one cell to another in small packages packed with their cargo to the right place at the right time in the brain<sup>2</sup>.

In addition, the various sensory impressions we receive, specifically the learner, about the external world through the senses, are not translated directly. They are all transmitted to their respective neural systems as electro-neural impulses. Therefore, encoding is a kind of initial encryption or coding of this information or knowledge acquired from the learner's external environment<sup>3</sup>.

This makes the learner a creator of previous cognitive links and integrates them with other links during the educational learning process, specifically during physical education and sports classes. Since the learner performs symbolic representation in a non-sensory way before the actual motor performance of the sports skill, he also performs it after applying his motor record plan associated with that skill, specifically after the feedback he performs between himself and the corrector of the motor behavior.

From this perspective, we ask the following question:

What is the relationship between the development of cognitive symbolic representation and academic achievement among baccalaureate students during physical education and sports classes?

### **Study Hypotheses:**

**General Hypothesis:** There is a positive relationship between cognitive symbolic representation and academic achievement among baccalaureate students during physical education and sports classes.

**Sub-hypothesis:** A strong positive relationship exists between cognitive symbolic representation and academic achievement among baccalaureate students during physical education and sports classes.

### **Study Objectives:**

Objectives are defined as "future possible stations, time-bound, achievable, and then measurable<sup>4</sup>.

- To explore the workings of the brain during cognitive symbolic representation. This is an internal, covert process, as opposed to an overt or external one.
- To highlight the importance of cognitive psychology in the educational-learning process, specifically during physical education and sports classes for baccalaureate students.
- To determine the relationship between cognitive symbolic representation and academic achievement among baccalaureate students during physical education and sports classes.
- To verify the proposed hypothesis that there is a strong positive relationship between the two study variables.

## Previous Studies:

### ❖ Study by Zaineb Abdul Kazim Ghanem<sup>5</sup>:

The study entitled "The Efficiency of Cognitive Representation of Information, Self-Efficacy Expectations, and Their Relationship to Learning Styles among University Students," conducted by researcher Zaineb Abdul-Kazim Ghanem, was submitted to the College of Education Council at Al-Mustansiriya University as part of the requirements for obtaining a PhD in Educational Psychology.

This study aimed to investigate the relationship between the efficiency of cognitive representation of information, self-efficacy expectations, and learning styles.

Specifically, the study sought to:

Identify the significance of the differences in the relationship between:

- ✓ The efficiency of cognitive representation of information and learning styles according to gender and specialization.
- ✓ Self-efficacy expectations and learning styles according to gender and specialization.
- ✓ The efficiency of cognitive representation of information and self-efficacy expectations according to gender and specialization.
- ✓ Explore the relationship between the efficiency of cognitive representation of information, self-efficacy expectations, and learning styles among university students.

To achieve the research objectives and hypotheses, the researcher prepared:

1. A scale for the efficiency of cognitive representation of information according to Saloo's perspective.
2. A scale for self-efficacy expectations according to Bandura's perspective on this concept.
3. An adaptation of the Learning Styles Scale (Entwistle's model) to the Iraqi environment.

After completing the preparation of the research tools, the researcher applied them to an applied sample of (300) male and female students, who were selected using the stratified random method.

A set of statistical methods were used to analyze the results, including:

- The t-test for one sample
- The t-test for two independent samples
- Pearson's correlation coefficient
- Cronbach's alpha coefficient
- The chi-square test
- The multiple correlation coefficient

Through this study, the researcher reached the following results:

- ✓ Science students excelled in the relationship between the efficiency of cognitive representation of information and deep learning style compared to humanities students.
- ✓ Males outperformed females, and humanities students outperformed science students in the relationship between the efficiency of cognitive representation of information and superficial learning style.
- ✓ Science students also outperformed humanities students in the relationship between the efficiency of cognitive representation of information and strategic learning style.
- ✓ No differences were found between males and females in that relationship.
- ✓ Females outperformed males, and science students outperformed humanities students regarding self-efficacy expectations and deep learning style.
- ✓ No statistically significant differences were found according to the gender and specialization variables in the relationship between self-efficacy expectations and superficial learning style.
- ✓ No statistically significant differences were found according to the gender and specialization variables in the relationship between self-efficacy expectations and strategic learning style.
- ✓ Science students outperformed humanities students in the relationship between efficiency of representation and self-efficacy expectations.
- ✓ No statistically significant differences were found between males and females in that relationship.
- ✓ In addition, it was found that there is a positive linear correlation between the three research variables.

### **Recommendations:**

Based on the findings, the following recommendations are made:

- ❖ University professors should emphasize understanding and application in their teaching, rather than memorization and recall only. This will help students adopt a deep learning style.
- ❖ A correlational study should be conducted between the efficiency of cognitive representation of information and academic achievement, achievement motivation, or multiple intelligences.

❖ Study by Fatma Saoirsi Mehmet<sup>6</sup>: « Cognitive Functioning in UK-based Football (Soccer) Players, with emphasis on Social Cognition »

This study was conducted to obtain a PhD in Clinical Psychology from the University of East London. It was discussed in June 2021.

The researcher found that, with the growing interest in the field of neuropsychology in the sports field, especially concerning brain injuries in football players, and with the widespread recognition that sports-related concussions are linked to the athlete's cognitive performance on the field, the cumulative effect of mild sports-related head injuries remains largely important. This is because football is the only sport that includes head impacts as an integral part of the game. Moreover, despite being the most popular sport in the world, studies on it are still not extensive, and social cognition is still completely neglected in football literature, despite the recent media interest in the potential neuropsychological effects of the game in the long term.

This study aimed to explore the associations between football-related behaviors and cognitive performance in 25 UK players. Participants underwent a battery of neuropsychological tests encompassing premorbid functioning, cognitive performance, and social cognition. Analysis revealed weaknesses in verbal functions, verbal memory, and social cognition (specifically, Theory of Mind). Additionally, weak associations were observed between football-related variables and their impact on player behavior, verbal memory, visual attention, and various social cognition measures. Notably, the study distinguished associations between quantified and cumulative concussions within this popular team sport.

### **Sample and methodology:**

#### **Sample:**

This study included a sample of 70 final-year (baccalaureate) students, utilizing a cluster random sampling approach, also known as multi-stage sampling.

**Methodology:**

A descriptive methodology was employed, as it best suited the study's requirements.

**Data collection tools:**

- ✓ Cognitive symbolic representation test:

Entesar Younes defines this test as "observing the individual's responses in a situation that includes stimuli that are purposefully organized, have specific characteristics, and are presented to the individual in a special way that enables the researcher to record and measure these responses accurately<sup>7</sup>".

The Cognitive Symbolic Representation Test was developed by Professor Paul R. Christensen and Joy Paul Guilford. It was printed in Paris and published by a specialized press for applied psychology in 1990.

The Center for Applied Psychology Publishing. Address: 25, rue de la Plaine 75980 Paris, Cedex 20

**Academic achievement:**

The students' baccalaureate (high school diploma) grades were used as a measure of academic achievement.

**Statistical data analysis:**

A range of statistical methods were employed, including:

- ❖ Pearson correlation coefficient: To determine the strength of the relationship between variables.
- ❖ Arithmetic mean and standard deviation: To describe the central tendency and variability of the data.

**Results:**

**Table 1:** Correlation between cognitive symbolic representation and academic achievement in baccalaureate students during physical education and sports classes.

Study variables	Mean	Standard Deviation	Correlation Coefficient	sig	Statistical Significance
Cognitive	28.4	7.74	0.908**	0.000	There is a

<b>symbolic representation</b>					significant correlation at the 0.01 level
<b>Academic achievement</b>	13.12	2.64			

**Table 1** shows that the mean score for cognitive symbolic representation was 28.4 with a standard deviation of 7.74. The mean score for academic achievement was 13.12 with a standard deviation of 2.64 for a sample of 70 baccalaureate students from different high schools in (Annaba state) in Algeria.

The correlation coefficient between the two variables was 0.908 with a probability value of 0.000. The results indicate that there is a statistically significant correlation at the 0.01 level between cognitive symbolic representation and academic achievement.

After an initial reading of the table, we can conclude that:

Since the probability value of 0.000 is less than the significance level of 0.01 (  $P \text{ value} = 0.000 < (\alpha = 0.01)$  ), we can reject the null hypothesis ( $H_0$ ) that there is no strong positive relationship between cognitive symbolic representation and academic achievement in baccalaureate students during physical education and sports classes. We can therefore accept the alternative hypothesis ( $H_1$ ) that **there is a strong positive relationship between the two variables.**

This means that the process of encoding information received during physical education and sports classes is strongly positively correlated with academic achievement in baccalaureate students. Students who scored high on the baccalaureate also scored high on the cognitive symbolic representation test, while those who scored low on either the test or the baccalaureate did so as well. This is consistent with several scientific studies that have found that information storage occurs as symbols that can be manipulated in the same way as mathematical symbols. For example, the number 2 and the Roman numeral II are both symbols used to represent the concept of "two."

This has allowed researchers to study processes such as perception. Models of perception have relied on feature detectors that store information about features encountered in the world (such as lines, curves, and colors). These features that we see are stored as distinctive symbols in our minds<sup>8</sup>.

This suggests that physical activity during physical education and sports classes can help to open up and stimulate brain cells, which in turn can lead to an

increased ability to form multiple and diverse solutions to problems. This is done by accessing the motor records stored in the brain and decoding them. This can then be used to add, delete, modify, or generate new motor-skill knowledge that can be used in various areas of life, starting with academic achievement.

These results are consistent with the study by Stevens (1992), who found that a good cognitive structure (in terms of both quantity and quality) helps to build good mental representations. These representations then enrich that knowledge again (a reciprocal relationship)<sup>9</sup>.

The efficiency of the cognitive information storage process is also generally affected by the effort that the individual makes to encode and organize what is being stored<sup>10</sup>.

### General conclusion:

There is a strong positive relationship between the development of cognitive symbolic representation and academic achievement in baccalaureate students during physical education and sports classes (**both hypotheses are confirmed**).

### References :

1. Al-Zaghloul, I. A., & Al-Hendawi, A. F. (2013). *Introduction to psychology*. Amman, Jordan: Dar Al-Masirah for Publishing, Distribution, and Printing.
2. Ayam Wahab Razzaq. (2015). *Al-Burmani: Models of mental representation of information and their relationship to learning and memorization strategies*. Journal of the University of Babylon-Humanities, 23(4), 2125-2140. Retrieved February 2, 2023, link:[382a81ea01f98c00 \(iasj.net\)](https://doi.org/10.3390/biom10040547).
3. Baba aami, M. (2014). *An approach to understanding scientific research*. Syria-Damascus: Dar Wahi Al-Qalam.
4. Boudaoud, A. Y. (2010). *Methods of scientific research: Sciences and techniques of physical activity*. Algeria, Office of University Publications

<sup>1</sup>Fakhri Abdel Hadi (2009). Cognitive Psychology. Ousama Publishing and Distribution House, Jordan, p. 15 (with modifications).

<sup>2</sup> Jean Pierre CHANGEUX: *Discovery of the first neurotransmitter receptor-the acetylcholine nicotinic receptor*, biomolecules review, volume 10, issue 4, April 2020, ( Retrieved 14/03/ 2022 ), link: <https://doi.org/10.3390/biom10040547>

<sup>3</sup> Al-Zaghloul, Emad Abdel Rahim and Al-Hindawi, Ali Faleh (2013): *Introduction to Psychology*, Dar Al-Masirah for Publishing, Distribution and Printing, Amman-Jordan, p. 260 (with modifications).

<sup>4</sup> Baba aami, M. (2014). *An approach to understanding scientific research*. Syria-Damascus: Dar Wahi Al-Qalam

<sup>5</sup> Zaineb, A. K. G. (2011). *The efficiency of cognitive representation of information and self-efficacy expectations and their relationship to learning styles among university students*. PhD dissertation, Department of Educational Psychology, University of Mustansiriyah.

<sup>6</sup> Mehmet, Fatma Saoirsi: *Cognitive Functioning in UK-based Football (Soccer) Players, with emphasis on Social Cognition*, clinical psychology university of east london, for the professional Doctorate Degree, june 2021.

<sup>7</sup> Boudaoud Abdel-Yamine, (2010): *Scientific Research Methods in Physical Activity Sciences and Techniques*, Algeria, Office of University Publications, p. 68.

<sup>8</sup> Dawn M. McBride and J. Cooper Cutting, *cognitive psychology ,Theory, Process and Methodology – 2<sup>nd</sup>ed*, sage, london, P33.

<sup>9</sup> Ayam Wahab Razzaq Al-Burmani: *Mental Models of Information and Their Relationship to Learning and Memorization Strategies*, Published Article, Journal of Babylon University - Humanities, Volume 23, Number 4, 2015, p. 2133. Link to the article (02/02/2023): 382a81ea01f98c00 (iasj.net)

<sup>10</sup> Shebli Mohammed. (2001). *Introduction to Cognitive Psychology*. Dar Gharb, Cairo, Egypt, pp. 132-133.