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METACOGNITIVE SKILLS OF INTELLIGENT AND SLUGGISH TECHNICAL INSTITUTE STUDENTS

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Abstract- This study aimed to assess the level of metacognitive skills among students attending technical institutes in Iraq. A sample of sixty-four students was randomly selected to participate in the study. The researchers utilized a metacognitive scale comprising 42 items to evaluate the students' metacognitive abilities across various domains, including knowledge of knowledge, knowledge organization, and knowledge processing. The findings of the study demonstrated a distinct and significant disparity in the average performance levels between highly motivated and less motivated students. The statistical analysis revealed a substantial gap in the mean scores obtained by bright students in comparison to their sluggish counterparts. These results indicate that intelligent students possess higher levels of metacognitive skills than their less motivated peers. By identifying and quantifying the differences in metacognitive abilities, this study provides valuable insights into the cognitive processes and self-regulation strategies employed by students in technical institutes. Understanding these variations can contribute to the development of targeted interventions and instructional approaches to enhance metacognitive skills among students with lower motivation levels. Furthermore, this research sheds light on the importance of fostering metacognitive skills in educational settings, as they play a critical role in promoting effective learning and academic success.

Keywords: Metacognitive Skills, Intelligent Students, Sluggish Students, Technical Institute, Engineering Education.

1. INTRODUCTION

The interest of educational scientists in the theories of teaching and learning increased greatly in the beginning of the twentieth century and cognitive theories began to take up a large space for studies and research, after which the term metacognitive appeared for the first time by (Flavell, 1979) to change the course of research towards metacognitive studies and theories of thinking. This concept added a new domain in cognitive psychology and opened horizons for experimental research in the topics of thinking, intelligence and learning skills. This concept evolved a lot in the end of the last century and interest in it continues to this day because of its association with theories of intelligence and strategies for solving problems and decision-making [2]. The skills of metacognitive thinking are very similar to the case of a person standing outside his brain and then reading the processes going on in his brain as if he were reading in a book open to him and reading what is going on in the lines and below and behind them [3]. The concept of metacognitive thinking skills is based on the foundations and determinants, the most important of which are: (the individual's idea of his thinking, metacognitive knowledge, metacognitive skills and the individual's metacognitive experiences [4].

Metacognitive thinking is defined as thinking about thinking [5], that is, meditating on knowledge, deepening its understanding and interpretation, exploring the domains of the phenomenon and inferring its hidden domains through living systems of research and investigation [1]. Metacognitive skills can be defined as the learner's knowledge of how, when, and why he or she uses certain strategies to accomplish a particular task [6-8]. The current study focuses on the community of high abilities and low abilities students who need all of us to collaborate to provide appropriate services to them and to determine the extent to which they possess metacognitive skills to stand and improve them in the future.

1.1. The Problem of Study

Many studies have dealt with the intelligent and slow students because of its direct link to mental activity, but it is considered as one of its most important supports. Despite this, we see a few researches that address the intelligent and slow students associated with mental skills in general and metacognitive skills in particular. Therefore, the problem of the current study is to achieve a precise understanding of the relationship between the metacognitive skills of the outstanding and low students of Babylon Technical Institute.

1.2. Study Questions

The Study inquiry necessitates addressing the following key questions:

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1. What is metacognitive skills level of the scale as a whole and its domains among Babylon Technical Institute students?
2. What is the relationship between metacognitive skills the students' level on each domain and its sub-domains among Babylon Technical Institute students?

1.3. Aims of the Study

The present study objectives at:
1) Knowing the level of metacognitive skills of Babylon Technical Institute students regarding the scale as a whole and its domains.
2) Identifying relationship between metacognitive skills and students' level.

1.4. The Study Hypothesis

The hypothesis posits that, at a significance level of 0.05, there is no statistically significant disparity between the average scores of metacognitive skills exhibited by intelligent students and sluggish students, both in their first and second semesters.

1.5. Study Limits

The study is limited to first year students/ Department of Power Mechanics /Babylon Technical Institute for the academic year 2020-2021.

1.6. The Importance of the Study

Concentrating on metacognitive skills, as an important factor in the learning and teaching process, comes from their great importance and role in teaching students how to learn, and facilitating information retrieval. The exclusion of this type of skill and its absence from the learning and teaching process leads to a lack of transmission of the impact of learning and hinders the processes of thinking, reflection and creativity [9].

Hence, it is crucial to highlight the significance of the present study, which can be summarized as follows:
1. Metacognitive skills role of in the field of academic achievement and how to improve and exploit those skills to reach a remarkable academic achievement.
2. Emphasizing on high abilities students because of their high-level performance in all fields to the extent that they are smarter to their peers of the same age, school stage and gender.
3. Confirming on technical institutes students and improving their mental skills as future leaders.

2. THEORETICAL FRAMEWORK AND PREVIOUS STUDIES

2.1. The Concept of Meta-Knowledge

Flavell defined meta-knowledge as: The individual's knowledge of what is related to his cognitive processes, the outputs of those processes, the characteristics related to the nature of knowledge and information, and everything related to them, such as appropriate priorities for learning information or data, based on active evaluation, adjusting and organizing these processes in the light of cognitive topics or data. It is obvious that this definition includes three different manifestations:
1) The individual's knowledge of their cognitive processes and the outcomes resulting from those processes.
2) The individual knows the appropriate priorities for learning information.
3) Adjust, organize and evaluate cognitive processes.

It refers beyond knowledge to thinking and identifies "what we know" and "what we don't know" as she acts as an executive director of thinking management [10].

Additionally, it encompasses the concept of "metacognition," which refers to knowledge about one's own knowledge. While human knowledge pertains to the external data and information provided to individuals, metacognition delves into internal knowledge and information processing mechanisms. Moreover, metacognition extends beyond knowledge by examining how individuals think and regulate their cognitive processes. It involves understanding and controlling one's own cognitive operations, reflecting a higher level of cognitive awareness and self-regulation [11]. Beyond knowledge means an individual's thinking in his own thinking and includes the knowledge of himself, for example: determining what he knows and what he has learned and determining what the learner can do to improve his learning and achievement. Beyond knowledge includes cognitive skills, problem sense, identifying problem elements, planning what he is doing to solve problems, monitoring his progress, and evaluating results of his own thinking or problem-solving activity [12].

As Exford points out those meta-knowledge strategies consist of:
1. Focus on the learning process: A holistic view of the topic and connect what is new to what is known before with focusing attention on the topic and good listening.
2. Organization and planning of learning includes organizing knowledge and setting public and private goals as well as seeking opportunities for practice, understanding the subject of learning, organizing schedules, the environment surrounding learning, and general planning.
3. Learning assessment includes the process of self-monitoring and evaluation [13].

2.2. Metacognitive Skills

The concept of metacognitive thinking skills is based on the foundations and determinants, the most important of which are: (the individual's idea of his thinking, metacognitive knowledge, metacognitive skills and the individual's metacognitive experiences [4]. Accordingly, metacognitive skill can be defined as the highest level of mental activity that keeps an individual aware of himself and others while thinking about problem solving" [1].

On the same line, Reed Geertsen (2003) referred to such skills as follows: "It is to stand outside the mind and direct the process of carrying out a certain thinking task, such as analyzing a problem, classifying data or producing a hypothesis, this means that the individual does two types of thinking at once, ordinary thinking and thinking about thinking" [14]. Many sources such as Meale (2005), Gama (2005) and Champagne Hansen and Schenkkan, (2022) have identified metacognitive skills as follows:

2.3. Knowing of Knowledge

Knowledge encompasses three main types: declarative knowledge, procedural knowledge, and conditional knowledge. In this study, the degree to which a student obtains the sub-scale of metacognitive thinking is determined.

2.4. Organization of Knowledge

It signifies an individual's cognizance of their own learning strategies or problem-solving approaches, along with their capacity to employ alternative strategies to rectify misconceptions and improve performance Metacognitive activities pertain to actions that promote advancement in the learning journey. For instance, a student may engage in self-reflective questioning such as: "What am I currently engaged in?", "What strategies should I employ to enhance my learning?", "How should I approach the task at hand?", "What information is essential to successfully complete the given assignments?", "Should I explore alternative paths?", "How should I manage my pace?", and so forth. These metacognitive inquiries aid in directing and guiding the learning process, allowing individuals to evaluate their actions, make informed decisions, and optimize their learning experience. These are some of the monitoring activities that can appear during learning activities, including:

1. Keep the goal in focus
2. Maintain the sequence of steps
3. Know when each sub-goal is achieved
4. Determine when to move on to the next process
5. Discover difficulties and mistakes
6. Know how to overcome obstacles, get rid of mistakes

2.5. Knowledge Handling

It means the ability involves the capacity to assess performance and evaluate effective strategies following learning or problem-solving endeavors. It refers to an individual's self-evaluation of their learning processes, encompassing the assessment of progress in various learning activities. Proficiency in assessment skills assists students in developing a toolkit of essential skills and strategies that aid in the learning process and facilitate improvement. Some of these skills and strategies include:

1. Evaluating the extent to which the goal has been achieved.
2. Judging the accuracy and adequacy of the results.
3. Evaluating the appropriateness of the methods he used.
4. Evaluating how to overcome difficulties and mistakes.
5. Evaluating the effectiveness of the plan and strategy used and how to implement it.

2.6. Definition of Intelligent Student

It can be defined as the student who reaches a high level of academic achievement, making him the best among his group [18].

2.7. Definition of Sluggish Student

McFayden et al., (2022), defined such student as the student has a low-grade point average, due to his inability to understand the prescribed curriculum in all subjects or in certain subjects.

3. PREVIOUS STUDIES

3.1. Al Khaqani, 2008

The study is entitled "Beyond-Knowledge Strategies for Ordinary, Distinguished and Talented Middle School Students". It was conducted in the province of Baghdad and aimed to identify the use of meta-knowledge strategies among ordinary, distinguished and talented students and the differences between them and the differences between them by sex. The research sample comprised a total of (631) students, selected from ordinary, talented, and distinguished middle schools. The sample distribution consisted of (360) ordinary students, (240) distinguished students, and (31) talented students. To accomplish the research objectives, the researcher developed a meta-knowledge strategies measure. Mon variance analysis was used as the T-test in the statistical analysis of its research results. The results resulted in gifted students making significant use of meta-knowledge strategies in their study of the courses offered to them, and outstanding students use extra- cognitive strategies to a lesser degree than gifted students. Ordinary students exhibit limited utilization of meta-knowledge strategies, highlighting their relative weakness in employing such strategies. On the other hand, statistically significant differences exist, favoring talented students, who demonstrate a more proficient and effective utilization of these strategies. Among the various meta-knowledge strategies, the planning strategy emerges as the most commonly employed by students across the sample. This suggests that talented students, in particular, excel in their ability to plan and organize their learning processes, resulting in enhanced metacognitive awareness and improved academic performance. The strategies least used by the distinguished and the plain are the strategy of monitoring and controlling and the existence of statistically significant differences in favor of talented and talented students in their use of meta-knowledge strategies.

3.2. Abajji, 2010

This study is entitled **"**The impact of using meta-knowledge strategies on the achievement of fourth graders in biology in the Nineveh Governorate Center" It was conducted in Nineveh Governorate in 2007 and focused on investigating the influence of utilizing meta-knowledge strategies on the academic achievement of fourth-grade students in the field of biology. The research sample comprised a total of (80) students, divided equally between an experimental group and a control group, with each group consisting of (40) students. The experimental group received instruction that incorporated the use of meta-knowledge strategies, while the control group followed the conventional teaching approach. In the statistical analysis of the research findings, the researcher employed the T-test to examine the observed data. The results revealed statistically significant differences between the experimental and control groups, favoring the experimental group. These findings strongly suggest that the incorporation of meta-knowledge strategies in the instructional process positively impacts the academic achievement of fourth-grade students in biology.

4. METHODOLOGY AND PROCEDURES

To fulfill the objectives of the current study, a one-group pre-test post-test design was adopted, employing the descriptive research method.

4.1. Population and Sample

The population of the present study consists of first-year students at some scientific departments of Babylon Technical Institute (morning studies) for the academic year (2020-2021). They were 978 students distributed over six scientific departments (Table 1).

Table 1. The population of the study

The Total Number of Students	Department of Power Mechanics	Department of Mechanics	Department of Civil Engineering	Department of Electronics	Department of Medical Apparatus	Department of Survey
978	70	147	151	203	310	97

The sample for this study consisted of first-stage students from the Power Mechanics Department. Initially, there were a total of 70 students, including both male and female participants (67 male and 3 female). However, after excluding those who did not meet the study criteria or experienced academic difficulties, the final sample consisted of 64 male students. The selection process aimed to ensure a homogeneous group of participants for the study, focusing specifically on male students due to the specific context or requirements of the Power Mechanics Department (Table 2).

Table 2. The sample of the study

Intelligent Students	Intermediate Students	Slow Students	Total
31	23	10	64

According to Table 2 above, the sample of the study has been divided into 31 intelligent students, whose average ranges from (80-100%), 23 middle students with averages ranging from (66-79%), and 10 slow students whose averages (0-65%).

4.2. Instrument of the Study

The researchers adopted the metacognitive scale developed by [22]. The scale consists of 42 items divided into three domains: Knowing the Knowledge, knowledge organization, and knowledge processing. To ensure the validity of the items of the scale in terms of clarity, accuracy, and consistency, it has been exposed to a number of experts who reviewed the scale and judged its validity. Reliability was measured through Alpha Cronbach. The results ranging from (0.72-0.78) respectively, which indicates that the scale is reliable. Metacognitive scale is intended to be answered to five–point Likert Scale (always, often, sometimes, rarely, absolutely) Marks are assigned as follow: always 5, often 4, sometimes 3, rarely 2, absolutely1. Students' levels of metacognitive skills were divided into different categories according to the following criteria:

- Low Level: Scores ranging from 1 to 2.33 indicated a low level of metacognitive skills.
- Moderate Level: Scores ranging from 2.34 to 3.67 indicated a moderate level of metacognitive skills.
- High Level: Scores ranging from 3.68 to 5 indicated a high level of metacognitive skills.

5. PRESENTATION AND DISCUSSION OF RESULTS

Findings pertaining to the initial study question: "What is the level of metacognitive skills of the scale as a whole and its domains among Babylon Technical Institute students?

To answer this question, mean and standard deviation of students' grades were calculated on the scale as a whole and on each of its domains as in Table 3.

Table 3. Metacognitive skills among the students

Domains of the Scale	*N*	*Mean*	*Std. Deviation*
Knowing of knowledge	64	3.84	0.79
Organization of knowledge	64	3.77	0.53
Knowledge Processing	64	3.61	0.53
Metacognitive skills	64	3.75	0.63

Table 3 shows that the sample members possess a high level of metacognitive skills for the scale as a whole, while the domains ranged from a high level of the two domains (knowing knowledge and knowledge organization) to an average level of domain (knowledge treatment). The mean scores of the metacognitive skills of the scale as a whole is (3.75) and a standard deviation (0.63), The mean score for the Knowing of knowledge dimension is (3.84) with a standard deviation of (0.79). Similarly, the mean score for knowledge organization is (3.77) with a standard deviation of (0.53). Lastly, the mean score for Knowledge processing is (3.61) with a standard deviation of (0.53). These statistics provide insights into the average scores and variability within each dimension, indicating the level of proficiency and consistency in each area of metacognitive skills.

Findings pertaining to the second study question: "What is the relationship between metacognitive skills the students' level on each domain and its sub-domains among Babylon Technical Institute students?

To address this question, various statistical measures were calculated to analyze the students' grades on the scale as a whole and within each domain. These measures include the mean, standard deviations, and the T-value. The results are presented in Table 4, providing a comprehensive overview of the students' performance and achievement across the different domains of the scale. Table 4 above shows that the mean scores of the intelligent students is higher than that of sluggish students.

To confirm this difference, *T* value for two independent samples is used, where the calculated *T* value of the scale as a whole is 15.57 for intelligent students and 24.01 for sluggish students. The calculated *T* value for the domain of knowing knowledge of intelligent students is 27.35 and that of sluggish students is 20.88, whereas the *T* value of domain of organizing knowledge is 18.59 for intelligent students and11.29 for those of sluggish students.

Table 4. Mean, standard deviation of intelligent and sluggish students for the scale as a whole and on each of its domains

Students Group and Metacognitive Skills		*N*	Mean	*SD*	*t*	*df*	*sig.*
Knowing of knowledge	Intelligent Students	10	2.62	0.15	27.35	39	0.00
	Sluggish Students	31	4.54	0.27	20.88	27.394	
Organization of Knowledge	Intelligent Students	10	3.08	0.07	18.59	39	0.00
	Sluggish Students	31	4.24	0.31	11.29	37.780	
Knowledge Treatment	Intelligent Students	10	2.96	0.073	19.43	39	0.00
	Sluggish Students	31	4.08	0.29	11.83	37.937	
Metacognitive Skills	Intelligent Students	10	2.86	0.10	24.01	39	0.00
	Sluggish Students	31	4.31	0.28	15.57	38.623	

Finally, the *T* value of the knowledge treatment is 19.43 for intelligent students and 11.83 for sluggish students. These findings unmistakably demonstrate a statistically significant distinction between intelligent and sluggish students. The observed data provides strong evidence that there are notable disparities in academic performance or achievement between these two groups. Thus, it has been shown that the students of the Technical Institute in Babylon (intelligent and sluggish students) are characterized by a high level of metacognitive thinking. This result differs from that of Al Khaqan, (2008) and Abajji, (2010) studies in which students' metacognitive thinking level is intermediate.

The researchers attribute this result to the fact that students have good information that greatly helped them in developing their thinking abilities, especially metacognitive skills. Students are within an educational institution and in direct contact with various fields of science and knowledge. Furthermore, student at this period of study is more developed and self-aware and have a high degree of control, future planning, analysis and high self-ability. The facilitation strategies and instructional methods employed by teachers play a crucial role in nurturing the development of students' metacognitive skills. Teachers contribute to this development by assigning various tasks, such as reports and scientific research projects, that engage students in critical thinking and self-reflection. Additionally, teachers utilize supplementary educational resources and techniques to enhance students' metacognitive abilities. These strategies and instructional approaches foster a learning environment that promotes the cultivation and refinement of metacognitive skills among students, ultimately enabling them to become more self-aware, reflective, and strategic learners.

6. THE DISCUSSION OF THE RESEARCH HYPOTHESIS THAT STATED

The initial hypothesis proposed that there would be no statistically significant difference, at a significance level of 0.05, between the mean scores of metacognitive skills among intelligent and sluggish students across the first and second semesters. However, the results obtained from the analysis revealed clear and statistically significant differences between the mean scores of intelligent students and those of sluggish students. These findings indicate that there are notable disparities in metacognitive skill levels between these two groups, suggesting that intelligence may influence the development and utilization of metacognitive abilities. The observed differences underscore the significance of considering individual cognitive capabilities when examining metacognitive skills and their impact on academic performance.

Based on the results obtained, null hypothesis is rejected. The researchers attribute the reason to this to the fact that intelligent students have cognitive capabilities that enable them to increase their knowledge and organize that knowledge in their major, as well as continuous monitoring of all scientific developments which resulted in the development of their metacognitive skills than sluggish students.

7. CONCLUSIONS

Based on the findings obtained, the researchers have drawn the following conclusions:

1. The high intellectual processes of the students of the Technical Institute of Babylon reflected in their possession of a high level of metacognitive skills.
2. Because of the level of intellectual maturity that the students have, they become more able to make appropriate decisions that are characterized by rationality, which led to a high level of metacognitive skills.
3. Having exploratory and investigative abilities enabled them to have high levels in the domain's ns of metacognitive skills (knowledge, organization, knowledge processing).
4. The intelligent students have cognitive and organizational capabilities and knowledge processing, which resulted in an increase in of their metacognitive abilities more than their peers (sluggish).

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