Impact of Deep Learning Strategy in Mathematics Achievement and Practical Intelligence among High School Students

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Sabah Saeed Hammadi[1], Ban Hassan Majeed[2(✉)], Areej Khuder Hassan[2]
[1]General Directorate of First Karkh Education, Baghdad, Iraq
[2]College of Education for Pure Science/Ibn Al-Haitham, University of Baghdad, Baghdad, Iraq
ban.h.m@ihcoedu.uobaghdad.edu.iq

Abstract—To identify the effect of deep learning strategy on mathematics achievement and practical intelligence among secondary school students during the 2022/2023 academic year. In the research, the experimental research method with two groups (experimental and control) with a post-test were adopted. The research community is represented by the female students of the fifth scientific grade from the first Karkh Education Directorate. (61) female students were intentionally chosen, and they were divided into two groups: an experimental group (30) students who were taught according to the proposed strategy, and a control group (31) students who were taught according to the usual method. For the purpose of collecting data for the experiment, an achievement test was built, which is in its final form (25) test items and a practical intelligence test out of (20) test items of the objective type for both of them. Based on the findings, the students of the experimental group who studied according to deep learning strategies outperformed on those who by the traditional.

Keywords—strategy, deep learning, practical, intelligence, achievement, students, mathematics, high school

1 Introduction

The information revolution and the great knowledge explosion have affected the lives of peoples and societies. Since the school is the tool of society, this requires the provision of new generations capable of bridging the labor market, thinking, making decisions and solving the problems that they face within their environments. Vulner abilities and provide practical solutions to all the problems they encounter [1, 2]. Therefore, practical intelligence is considered one of the important variables that enable individuals to adapt to change and the environment, deal with what is available, enhance strengths to cover up weaknesses, and provide practical solutions to all problems they encounter. Practical intelligence depends on the tacit knowledge of the learner and its development is reflected in practical intelligence. It is an important and required ability in daily life. It is one of the types of active intelligence and indicates the success

of those who possess it. It is an important factor for adapting to the environment and shaping it to suit what is required. Whoever possesses this intelligence is able to identify strengths and weaknesses in any situation or problem he faces. Achievement is the main variable in determining the learner's transition from one stage to the next [3–5]. It was necessary to focus on these problems, which are essential in education and a primary goal that educational institutions seek to achieve. Therefore, deep learning strategies are among the modern strategies that deepen understanding among learners, make learning meaningful to them, and enable them to link new knowledge with previous knowledge. The deep learning strategy is one of the modern and new strategies. It works to deepen students' knowledge and retain information for long periods. Enable learners to actively interact in educational situations. It is also considered as developing critical thinking for learners. The current research problem can be summarized by asking: What is the effect of deep learning strategy on mathematics achievement and practical intelligence among secondary school students?

2 The theoretical framework

2.1 Deep learning strategy

The deep learning strategy is a set of methods that the learner uses and enables him to organize his ideas and link between the new knowledge and the previous knowledge and helps him to achieve meaningful learning and deep understanding of the learning material, as well as enables him to interpret and reflect on the learning material and rephrase it in his own vocabulary [6–9]. So, it's procedurally definition is as a set of methods and methods used by female students of the fifth scientific grade to increase their understanding of the material prescribed for them [10–12]. The deep learning strategy is a crucial factor in achieving the learner's learning goals, as it enables him to actively interact in educational situations, reflect on the scientific material, and link new experiences with previous experiences, as well as linking what he learns inside the school with what he learns in daily life outside the school [13, 14]. It makes the learner ask about things, why? not how? It also makes him seek understanding and satisfy his curiosity and personal interests in all subjects, and he spends his time learning various subjects, although they are outside the scope of the evaluation [15–18]. Deep learning strategies differ from surface learning strategies in that they focus on self-interest and make the learner always search for a more comprehensive and deeper meaning [19, 20]. These strategies help improve creative and innovative minds. It also works to organize and expand the ideas of the learners as it develops their critical thinking, and also helps them to integrate into what they learn and makes them retain information for long periods [21–24].

Learner characteristics in deep learning strategy. The student who learns according to these strategies has a number of characteristics, including the learner actively seeks to understand the subject and material of learning. Interact with learning material and benefit from evidence, research and evaluation [25]. He has a broad vision to connect ideas with each other. There is a self-motivation to learn and link new ideas to old ideas. Linking the learned concepts with the concepts of daily life inside and outside

the school. Extensive reading of vocabulary outside the textbook [26, 27]. Several studies indicated that educational games develop this strategy and through it academic achievement can be predicted. The researchers believe that this strategy deepens the learning of scientific material among students because it makes them search for meaning in order to understand, and makes them feel the importance of what they learned inside the school and employing it outside the school in their daily lives. This gives meaning to what they have learned and increases the school's connection to society and daily practical life [28, 29].

2.2 Practical intelligence

It is a specific and procedural context that allows individuals to develop rules that enable them to understand what happens in situations and to know what they must do to achieve their goals [30]. It is the skillful application of knowledge acquired from daily experiences, which represents tacit knowledge in specific situations, and we can say that it is the acquired knowledge based on the accumulation of skills and behaviors from tacit knowledge [31]. It can be said that "pi" enables those who possess it to provide solutions to practical problems in the outside world, and provides individuals with a series of strategies for solutions to the problems of daily life. It is based on tacit knowledge that refers to what the individual needs to know in order to work effectively in his environment, which is knowledge that is not taught clearly and explicitly and often is not verbally expressed and is measured through work-related problems [32–34]. Tacit knowledge includes the following: Self-specific knowledge, which is specific to self-motivation and regulation [35]. Special knowledge of managing others, which is related to relationships and social interactions [36]. Knowledge of task management, including knowledge related to planning, monitoring and evaluation of various activities [37].

Nature of practical intelligence. "Practical intelligence" differs from general intelligence in that it is active intelligence and guarantees the success of people who possess it in life, unlike general intelligence, which is passive and does not guarantee success in life for those who possess it [38, 39]. He asserts that the difference between academic and practical intelligences is in the sharp disparity in the types of problems faced by the individual in academic situations versus practical ones [40]. The problems we face in daily life are weakly related to the knowledge and skills acquired through formal education and classroom activities and practical problems are characterized by the fact that they require formulation and knowledge of the problem and are not specific and require the search for information and can have many answers and acceptable solutions and allow multiple paths to reach the solution and require previous experience as well as require participation and motivation [41]. Some researchers, believe that practical intelligence can be developed through tacit knowledge, non-express knowledge, and training through experimental work on various skills in laboratories and laboratories, and that practical intelligence helps predict the performance of individuals as it explains success in their daily lives [42–44].

Practical intelligent person traits. There are some features that characterize the owner of this intelligence, which is always searching for tacit knowledge in his

environment [20]. He realizes that tacit knowledge differs according to the environment, identifies strengths and weaknesses in his environment. Also knows how to ignore useless knowledge; realizes that no one is good at everything [45]. He masters his work well and strives to succeed in it. It takes advantage of strengths to compensate for weaknesses [46]. The researchers believe that seeking to increase the tacit knowledge of learners has an effective role in developing practical intelligence by linking what is learned within the school to the problems of daily life for students. Adopting the practical method in dealing with the problems presented has an effective role in developing and demonstrating this intelligence, and for this it is important to focus on the practical side in giving the scientific material and not be satisfied with the theoretical side only.

Practical intelligence measure. The measurement process is very important today due to the scarcity of tests and measures that measure this intelligence, so a test mechanism will be adopted (RUIZ), which is in the form of giving a set of scenarios, and each scenario is followed by a set of actions, suggestions or reactions, depending on the nature of the scenario. Each student is required to give a score from (1–7) for each procedure, suggestion, or reaction. A high score indicates the strength of his approval of the choice, and vice versa. Note that all the scenarios that will be adopted in the test are exclusively in mathematics.

2.3 Achievement

Achievement is proving the ability to accomplish what has been acquired of knowledge and educational experience that has been set for [47, 48].

3 Methodology

Researchers adopted the experimental research style, including the experimental design of two experimental plus control groups with a post-test, which is one of the real designs, as it represents deep learning strategy (independent variable); achievement with practical intelligence (dependent variables) [49]. The research community consisted of all the fifth scientific grade students/general directorate of education/Karkh 1st. As for research sample, researchers intentionally chose Ajnadayn preparatory school for girls to conduct the experiment because it contains four academic divisions for the fifth scientific grade. Randomly class (B) was chosen to be the experimental group which formed from (30) students; and division (A) to be the other group which is also (31). Both internal, the external safety of the design has been calculated, as in Table 1.

Table 1. Internal safety

Variable	Group	No.	SMA	Std. Dev.	t-test		Significance Level (0.05)
					Cal.	Tab.	
Age	Exp.	30	268.457	8.772	1.846	2	Not significant
	Con.	31	264.000	11.272			
Intelligence	Exp.	30	47.7	4.25	0.180	2	Not significant
	Con.	31	48.5	4.20			
Previous Achievement	Exp.	30	71.3	10.76	0.772	2	Not significant
	Con.	31	69.2	9.93			

3.1 The tools

Achievement test. The educational content was determined, specific behavioral objectives were formulated were (52) according to Bloom's taxonomy. A specification table was done to specify the questions for each of the six Bloom levels, and based on the opinions of arbitrators, the total number of questions was determined (25) of the objective type; Table 2 shows the details.

Table 2. Test map (specification table)

Behavioral Goals			Remember	Understanding	Application	Analysis	Sum
			12	16	18	6	52
Content			23%	31%	35%	11%	100%
Chapter	No. of lessons	relative weight	3	3	4	1	11
Five	14	45%					
Six	17	55%	3	4	5	2	14
Sum	31	100%	6	7	9	3	25

Statistical analysis of the items of the achievement test was carried out to obtain statistical indicators, and all of them were acceptable and it is recommended to keep them.

Practical intelligence test. The researchers looked at the theoretical background of the research that was presented in defining the features of the theoretical concept of practical intelligence. In light of the capabilities of practical intelligence, which were mentioned above, the test was built and its paragraphs consisted of (20) paragraphs of the objective type, which are in the form of giving a set of scenarios, and each scenario is followed by a set of procedures, suggestions or reactions. Then it was verified:

A-Face Validity: The researchers used the internal consistency method, and Cronbach's alpha equation was applied because it is one of the most common methods in calculating stability. The stability coefficient was (76.0), which is a good.

B-Reliability: Scale was applied to a random sample other than the research sample, consisting of (100) students from the fifth scientific grade, and the reliability coefficient was (0.76).

4 Results

4.1 Achievement

First hypothesis: "There is no statistically significant difference at the level of significance (0.05) between the mean scores of students of experimental group who studied the subject of math. assigned to them according to deep learning strategy, and students of the control group who studied the same subject in the usual method in achievement test". See Table 3.

Table 3. Achieve test

Group	Sample	Mean	Variances	Degree Freedom	T-Value		Statistical Significance at Level (0.05)
					Cal.	Tab.	
Exp.	30	70.16	21.06	59	2.534	2	Sig.
Con.	31	59.06	19.36				

It is noted from the above table that the calculated value of the t-test is higher than the tabular value at the significance level, which indicates a statistically significant difference in achievement. Therefore, the null hypoth. is rejected and the alternative is accepted. Researchers believe that strategy of deep learning help students in org anizing the mathematical subject according to pre-planned and organized procedures and activities, based on the previous information of the students, and increasing their collection of new mathematical concepts and information.

4.2 Practical intelligence

Second null hypotheses: "There is no statistically significant difference at the significance level (0.05) between the mean scores of the students of the experimental group who studied the subject of mathematics assigned to them according to the deep learning strategy, and the students of the control group who studied the same subject in the usual way in the practical intelligence test" was tested, as shown in Table 4.

Table 4. PIT

	N	SMA	SD	Var.	DF	t Value		Indi.
						Calculated	Tabular	
Experimental	30	10.34	3.55	12.6	59	2.230	2	signifier
Control	31	8.36	3.75	14.06				

Note: Indication level = 0.05.

Obviously, that calculated value of the t-test is bigger than the tabular value which indicates a statistically signi. difference in mental motivation. So, the null one is rejected and the alternative is accepted. From foregoing, it appears the experimental group is superior to the control group in mental motivation, depending on the T-value calculated for the experimental group, which is greater than the T-value calculated for the control group. The researchers believe that the reason may be the adoption of deep learning strategies in presenting the material and presenting mathematical concepts commensurate with the level of cognitive awareness of the students and the stage of intellectual and psychological maturity. Thus, topics in general and mathematical facts and concepts in particular were presented in a sequential and coherent manner.

5 Conclusions and recommendations

In the light of the final results, it can be concluded that the adoption of the deep learning strategy in teaching led for raising the level of academic achievement of fifth-grade female students in mathematics. Plus, the development of tools to measure practical intelligence, appropriate to the educational stage within the specified age group. So, for educators we recommend to adopt modern teaching strategies to develop the mental abilities of learner. In addition, pay attention to mental abilities, including practical intelligence, which provides students with practical skills to solve problems that they face in daily life. For the general directorate of curricula, focus on employing mathematics topics in the daily lives of students.

6 Suggestions

As a complement to the current research, the researchers suggest conducting a similar study on male students and comparing the results. Also study of the impact of deep teaching strategy on other variables such as creative thinking and systems thinking. Conduct study with the same variables for other academic levels.

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8 Authors

Sabah Saeed Hammadi; He is presently Asst. Prof. Dr.; Teacher at Mutamayzi Al-Khadra High School/Karkh First Education, Baghdad province, Baghdad, Iraq. He is interested in methods of teaching mathematics. He is the author of a book called Ordinary Differential Equations. E-mail: dsabah159@gmail.com

Ban Hassan Majeed; She is presently Asst. Prof. in Mathematics Education and one of the faculty members in the College of Education for Pure Science/Ibn Al-Haitham, Computer Department, University of Baghdad, Iraq. E-mail: ban.h.m@ihcoedu.uobaghdad.edu.iq

Areej Khuder Hassan; She is presently Asst. Prof. Dr. in Methods of Teaching Mathematics and one of the faculty members in the College of Education for Pure Science/Ibn Al-Haitham, Computer Department, University of Baghdad, Iraq. E-mail: areej.k.h@ihcoedu.uobaghdad.edu.iq

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