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Designing a Teaching-Learning Based on Landamatics in Computer Architecture and Its Effect in Achievement

A research submitted by:

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Abstract:

Computer architecture is important and difficult subject in computer department, so it needs always to learn and teach it carefully and in more interest. This is because computer architecture deals with software and hardware, and it needs theoretical and practical aspects.

The research has aimed to prepare a teaching according to Landa theory in computer architecture subject and check its effect on achievement of the student of 2nd stage in computer department of Education College in Diyala University.

This research deals with designing a learning system for teaching computer architecture. In this project the sample was (74) students divided into two groups (38) as experimental and (36) as control.

The researchers tool was an achievement test containing (15) items to estimate the levels of Meril classification " remember, use, and exploration". The result which used T-test that Experimental group that had learned according to Landamatics scores more than Control group in achievement test.

Hence that it was concluded that the knowledge orientation in the organized educational activities that were organized.

1. Introduction.

Computer architecture is one of the most important subjects in computer department. It contains learning of the two main parts of computer hardware and software and leaning the matching between them.

To learn hardware it is needed to introduce to computer components such as; memory microprocessor input and output and other components. The interface between microprocessor and other computer components must be studied. The microprocessor internal and external structure must be studied in order to interface computer components with it and programming it and its operations via assembly language.

Assembly language is one of programming languages which is used to program microprocessor to control the computer. This is the software part in computer architecture. So it will be treated as programming.

In teaching programming you have seen the following scenario;

A student knows the syntax of a programming language. (The knows that each statement does. Yet, the student cannot put the statements together into a program. The teacher is tempt to say "the student just can't think" and throw one's hands up in despair.). (Laurance L.Leff, 2000, p2.)

Lev Landa (1975) said "It is common knowledge that pupils very often possess knowledge that is necessary in certain subject, but they cannot solve problems. Psychologists and teachers often explain this by saying that their pupils do not know how to think properly, they are unable to apply their knowledge, the processes of analysis and synthesis had not been formed in their minds,..". Dr. Landa reports on an interview with a teacher of mathematics. Here, a teacher referred to one of her student who had just received a D in a geometry test. She said "He doesn't know how to think. He didn’t figure out that the chord should be considered as the side of an inscribed angle ". Lev Landa asked "why couldn’t he figure it out?" The teacher responded, "He couldn’t figure it out because he couldn’t figure it out, that’s why."Lev Landa points out "the problem ended where it really should have begun." 1976.

(Laurance L.Leff, 2000, p2)

This paper tells you how to begin when you have students in your class who appear not to be able to think, when you ask them a question in computer hardware or to write a program.

Lev Landa has developed an instructional technology termed Landamatics that addresses this problem. My paper shows how to a dress these students and their problems. These techniques are shown to enable

the students to produce more programs and more complicated ones than they would have otherwise. Dramatic results have been achieved by Landamatics .In one set of experiment; Dr. Landa developed a technique for breaking down the thinking processes for geometrical processes. Io construct a proof were isolated. This is in comparison and theories of geometry and then shown examples of proof. The teachers selected students who knew the necessary facts in geometry. This was shown by a test, and reinforced by review of material. However, the teachers felt that these individual students could hot solve problems and "were not skilled in the general procedure of thinking".

Prior to the instruction based on Landamatics, the students were only be able to solve an average of 25% of the problems…the best students of the group could only get 40% of the problems right. After the Landamatics instruction, in the second test, the students solved 87% of the problems!

In short Landamatics is available technique in computer science classroom. It is not a substitution for conventional knowledge and principles instruction to help students understand material; however, it does help students learn to complete problems and write more complicated problems than they would without these techniques.

(Laurance L.Leff, 2000, p3)

The primary goal of this theory is to teach general methods of thinking (the highest order thinking skills). It is intended for all situations, which through different content have similar general logical structures (often hidden) that allow one to mentally handle them in the same way by employing the same general mental operations. (Landa, 1999, p344)

Key Concepts:

- Type of learning.
- Instructional methods or frameworks.
    - Guided discovery.
    - Expository teaching.
    - Combination approach.

- Method skills; Actions; Logical structure; Internationalization; Automatization; Generalization.

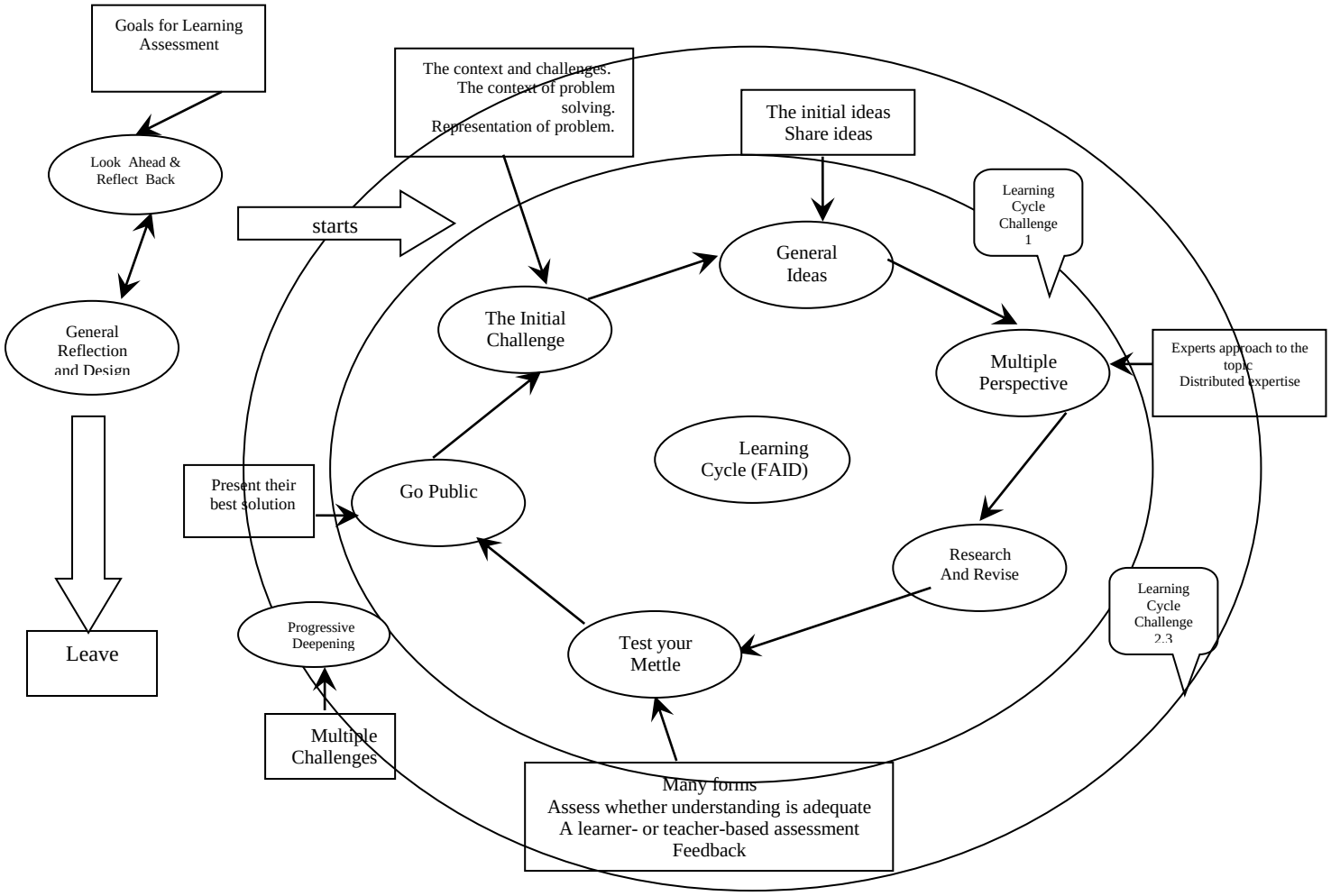

Figure (1): Concept map about Landamatics theory.
(Schwartx, D.L., 2002, p1)

Aim of research

The research aims to:
A learning model design-learning according to Landamatics in computer architecture subject for students of second stage/ computer department and its effect on their achievement in this subject.

Assumption of research

There is no statistical significant difference at level (0.05) between average marks of experimental group students that studied according to Landamatics, and average marks of students that studied according to ordinary method in achievement test.

Specifications of research

The research limits to:

1. Students of second stage/Computer Science Department/College of Education/Diyala University in studying year of 2005-2006.
2. Chapters of: I. Branches II. Delay
   III. Counters IV. Stack
   (Gaonker, Ramesh.S, 1986)
3. The first semester in studying year 2005-2006.

Expressions specification

1. Learning Organization

"The complete operation for analysis of needs and learning goals then forming a system in order to meet these needs. It includes forming subjects, learning activities and evaluating all educated activities." (Gagne & Briggs, 1977, p3)

2. Landamatics:

It's a technique where the teacher precisely defines and teaches the steps to do a problem.

(Laurence L.Leef, 2000, abstract, p1)

3. Achievement

A collection of knowledge and skills that acquired or made up of during learning studying subjects in a certain subject, calculate and regulate according to evaluating tests or teacher marks, or both together.

(Good, 1973, p7)

2. Case Studies

The last studies reflect the practical expertise that implemented of international, Arabic, and national in subject of this research. So according to importance of learning system, the researchers dealt with designing programs, learning materials and studied their effects on academic achievement of students.

This method is based on Landamatics to learn computer architecture, so some Landamatics last studies in learning will be listed.

- Laurance L.Leff: show its use in teaching programming. It draws on examples from the author's teaching in CS1, CS2, and CS3. This method is analogous to templates in famous programmers. Landamatics has increased the number of assignments completed in their classes. This study shoed the P=0.01 level.
  (Laurance L.Leff., 2000, p1)
- Al-Samaraai and Al-Chalabi: prepared a teaching design according to "Landa" theory regarding the numerical analysis subject and knowing its effect on the achievement of the students of 3rd stage mathematics branch /college of teachers/ Diyala University.

  The sample of research was a (31) student. Divided into (16) students as experimental group from mathematics branch and (15) student as a control group from computers branch.
  The researchers' tool was an achievement test containing 10 questions to estimate the levels "Remember, use, find" according to "Meril classification" the validity and reliability of the test were confirmed. The result has revealed that there are differences with statistical significance for benefit of the experimental group.
- Al-Chalabi (1998): Aimed to design a learning model in mathematics subject and showing its effect on students' achievement in Institute of Teachers. The study sample was (90) student distributed into three groups: an experimental group according to learning model, control group learned by the researcher and another control group learned by the same teacher that learned the experimental group to control the teacher coefficient in experiment. Inconsistency analysis and Toki test are use in analysis of results. The results showed that the experimental group is better than the two control groups. (Al-chalabi,1998)

3. Microcomputer Architecture

The microcomputer is making an impact on every aspect of our lives and soon it will plays a significant role in the daily functioning of all industrialized societies. Because of advances in semiconductors technology, an integrated circuit called microprocessor is used to be the central processing unit (CPU) of the computers. A computer designed using microprocessor is called a microcomputer.
Computers communicate and operate in the binary numbers 0 and 1, called bits. Each computer has fixed set of instructions in the form of binary patterns called a *machine language*. Since it is difficult for people

to communicate with computers in language of 0s and 1s, the binary instructions are given abbreviated names called mnemonics, which form the *assembly language* for a given computer.

4. Microcomputer Organization

Figure (2) shows a simplified but formal structure of microcomputer. It includes four components: microprocessor, input, output, and memory (read/write memory and read only memory). These components are organized around a common communication path called a *bus*. The entire group of components is called *system* or *microcomputer system*, while the components are called *subsystem*.

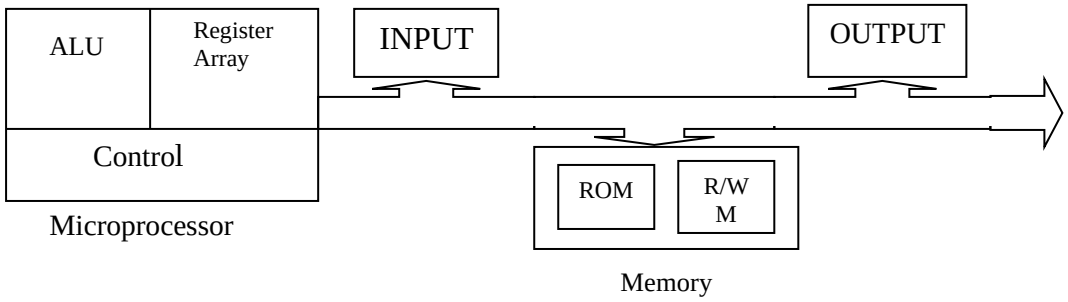

Figure (2): a block diagram of microcomputer.

The microprocessor is one component of microcomputer. On the other hand, the microcomputer is a complete computer similar to any other computer except that the CPU functions of the microcomputer are performed by the microprocessor.

4.1. Microprocessor

The microprocessor is a semiconductor device consisting of electronic logic circuits manufactured by using one of Integration techniques Scales. The microprocessor is capable of performing computing functions and making decisions to change the sequence of program execution. In large computers, the CPU performs these computing functions and it is implemented on one or more circuit boards. The microprocessor is in many ways similar to the CPU; however, the microprocessor includes all the logic circuitry (including the control unit) on one chip. For clarity the

microprocessor can be divided into three segments as shown in figure (1): Arithmetic/Logic Unit (ALU), register unit, and control unit.

4.2. Arithmetic/ Logic Unit

In this area of the microprocessor, computing functions are performed on data. The ALU performs arithmetic operations such as addition and subtraction, and logic operations such as AND, OR, and exclusive OR. Results are stored either in registers or in memory or sent to output devices.

4.3. Register Unit

This area of the microprocessor consists of various registers. The registers are used primarily to store data temporarily during the execution of a program. Some of registers are accessible to the user through instructions.

4.4. Control Unit

The control unit provides the necessary timing and control signals to all the operations in the microcomputer. It controls the flow of data between the microprocessor and peripherals (including memory).

4.5 Input

The input section transfers data and instructions in binary from the outside world to the microprocessor. It includes devices such as keyboards, teletypes, and analog to digital converters.
Typically, a microcomputer used in college laboratories either a hexadecimal keyboard or an ASCII keyboards an input device.

4.6. Output

The output section transfers data from the microprocessor to output devices such as Light Emitting Diodes (LEDs), Cathode-Ray-Tubes (CRTs), Printers, magnetic tape, or another computer. Typically single-board computers include LEDs and seven-segment LEDs as output devices.

4.7. Memory

Memory stores binary information such as instructions and data, and provides that information to the microprocessor whenever necessary. To execute programs, the microprocessor reads instructions and data from memory and performs the computing operations in its ALU section. Results are either transferred to the output section for display or stored in memory for later use. The memory block in figure (2) has two sections: Read-Only –Memory (ROM) and Read/Write memory (R/WM), popularly known as Random Access Memory (RAM).

The ROM is used to store programs that do not need alterations. The *monitor program* of a single-board microcomputer is generally stored in the ROM. This program interprets the information entered through a keyboard and provides equivalent binary digits to the microprocessor. Programs stored in ROM can only be read; they cannot be altered.

The read/write memory (R/WM) is also known as *user memory*. It is used to store user programs and data. In single-board microcomputers, in which instructions and data are entered through a hex keyboard, the monitor program monitors the keys and stores those instructions and data in R/W memory. The information stored in this memory can be read and altered easily.

4.8. System Bus

The system bus is a communication path between the microprocessor and the peripherals; it is nothing bus a group of wires that carries bits. The microprocessor bus is in many ways similar to a one track, express subway: the bus carries bits, just as the subway carries people. The analogy of an express subway with only one destination is more appropriate than that of a regular subway, because the microcomputer bus carries bits between the microprocessor and only one peripheral at a time.

5. Computer Languages

Computer recognizes and operates in binary numbers. However, each computer has its own binary words, meanings, and language. The words are formed by combining a number of bits for a given machine. The *word* (word length) is defined as the number of bits the computer recognizes and processes at a time. The word length ranges from 4 bits for small microprocessor-based computers to 64 bits for such large computers.

Each machine has its own set of instructions based on the design of its CPU or of its microprocessor. To communicate with the computer, one

must give instructions in binary language (machine language). Programmers can write programs called *assembly language* programs, using these words. Because an assembly language specific to a given machine. Programs written in assembly language are not transferable from one machine to another. To circumvent this limitation, such general-purpose languages as BASIC and FORTRAN have been devised; a program written in these languages can be machine independent. These languages are called *high-level languages*. (Gaonker, Ramesh.S, 1986, p7-10)

6. Procedure

6.1. Research Population and its Samples

Research society made up of second stage students/ Computer Science Department/ College of Education/ Diyala University in studying year 2005-2006. Their enumeration was (120) males and females distributed into three groups. Research sample was chosen randomly, so that group (A) represented experimental group and group (B) represented control group.
The two groups are equalized according to a previous achievement in subjects of computer architecture and artificial intelligence.

6.2. Experimental Design

Design of equivalent groups for dimensional measurement was used. Learning-learning design represented according to Landamatics and represents varied evaluation tended to experiment.

R1	X	R1	O
R2	Y	R2	O

(Campell & Stanly, 1966, p10)

So that:

Experimental group	R1
Control group	R2
Teaching-learning design	X
Ordinary method	X
Achievement test	O

6.3. Research Requirements

* learning design was prepared for subjects of computer architecture according to Landamatics rest to main stages of learning design as follows:

I. Analysis stage:

Contained the following analysis:

1. Educated needs.
2. Educated features.
3. Terms of learning content
4. General goals and creation of behavioral purposes.
5. Learning strategies.

II. Organization Stage

Contained:

1. Showing conception and rule.
2. Describing concept.
3. Knowledge conversion for actual operations by solving exercises and problems that reflects organization operations (algorithm) reaching more complicated operations (Heuristic).
4. Reveal about evaluation performance by using graduated problems and straitening students to self dependence on obtaining solutions discovering mistakes and trying to correct.

III. Achievement stage

Include:

1. Sowing the design to a group of professionals in computer and learning methods of mathematics for judgment on activity degree of learning material and its goodness.
2. Giving feedback to students after completing each unit as activities or varied test. That provides a chance for student to investigate about results of obtaining information and understanding learning material.

* Preparing teaching plans for research two groups

* Preparing evaluation test.

An objective test of choice of numerated, and deduction was prepared. This test consisted of (15) items classified according to Meril as (10) for remember level, (4) items for use level, and (one) item for exploration level.
The test was showed as basically form to a group of professionals in computer and learning methods of mathematics fields. According to professionals' advices some of items were changed. [Appendix B]

6.4. Validity of Test

The test showed to a group of professionals in computer and learning methods of mathematics to distinct their advices about test comprehensive for the degree of terms appropriation, so the test was considered as one surfaced truth, and using specifications table is considered as of test truth pointers. According to this outward truth and contents truth for test are limited.

6.5. Reliability of Test

Test is applied on an investigated sample from students of second stage/ Computer Science Department/ Education College/ Al-Mustansiria University of number (50) students (males and females) according to test stability coefficient using Crounbach-Alpha equation 20. So reliability coefficient reaches (0.83) which is accepted relationship in achievement test.

7. Results and Discussion

Statistical results for achievement test (Appendix B) that shown in table (1) showed experimental group students distraction on to control group students. As calculated T-Test value was (10.436) and it is greater than tabulated value which is (1.96). So it refuses this assumption.

Table (1): T-test results for difference between average marks of Experimental and Control groups.

Group	number	Mean	Standard deviation	Calculated T-Test value	Statistical significance

Experimental	38	52.34	13.384	10.436	Sig.
Control	36	43.79	10.368		

This result comes agreed with previous studies like (Laurance,), (Al-Samaraai, 2002) and (Al-Chalabi, 1998) that showed distraction of learning model in increasing students achievement compared with ordinary methods.

So restriction of Experimental group student can be referred to:

1. Learning contents arrangement so it agreed with educated levels and material nature.
2. Learning aims clearance and students' introduction to it simplified learning concepts, activities, and authorities. That caused to stimulate their activity and interest towards learning subject.
3. The material showed sequentially, and then each step tends to the next step. So student becomes able to make all activities, which stimulate discussion and conversation between students themselves and between students and their teacher about concepts related to subject.

8. Recommendations

Resting on learning model designing for learning computer architecture subject at teaching students of third stage of computer department.

9. Suggestions

Experimenting learning method on other studying subjects and various learning stages.

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Appendix A

Results of objective test for Experimental and Control groups.

Experimental group				Control group			
S	marks	S	Marks	S	marks	S	marks
1	53	20	32	1	63	19	51
2	42	21	81	2	44	20	49
3	45	22	42	3	41	21	58
4	50	23	37	4	52	22	38
5	46	24	52	5	54	23	34
6	49	25	54	6	48	24	35
7	69	26	69	7	40	25	44
8	47	27	63	8	43	26	36
9	35	28	56	9	25	27	46
10	55	29	47	10	42	28	59
11	56	30	35	11	41	29	39
12	86	31	44	12	61	30	38
13	51	32	59	13	32	31	38
14	56	33	53	14	69	32	35
15	53	34	56	15	40	33	41

16	43	35	51	16	41	34	42
17	79	36	47	17	44	35	29
18	56	37	53	18	38	36	53
19	43	38	45				

Appendix B

Objective Test Questions.

Q1: Choose the correct item:

1. One of the following instructions is not used in delay:
   a. MOV A,B b. ADD B c. DCR B
2. Stack is a group of locations in:
   a. microprocessor b. output c. memory
3. Delay is a way to decay the microprocessor:
   a. Speed b. time c. cost
4. An instruction in the following is stack instruction:
   a. POP PSW b. LXI H, 2090 c. MOV A,M
5. To calculate delay time we need to know the value of:
   a. T-state b. SP c. PC
6. Descending counter means decrementing a number, this number is put in: a. Register b. flag c. memory
7. PUSH is an instruction to transfer data from:
   a. MP to memory b. MP to stack c. MP to output
8. The following are delay steps:
   a. L1: DCR H b. JNZ L1 c. L1: INR H
   JNZ L1 L1: DCR H JNZ L1
9. In ascending counter, the number in counter in register is:
   a. cleared b. decremented c. incremented
10. POP PSW is used to reach the register pair:
    a. A and F b. B and C c. H and L

Q2: Write instructions necessary for each of the following:

1. Set zero flag using stack.
2. Transfer the data in (2020-2025H) to (2055-205AH) in reverse order.
3. Exchange the contents of HL with the contents of BC using stack.
4. Set D0 then D4 then D7 from port 04 with delay 1 second for each setting.

Q3: Explain the operation of the following program:

```
        LXI SP, 209AH
        MOV A, 00H
L2:     OUT 05H
        PUSH PSW
        LXI H, 07FFH
L1:     DCX H
        MOV A, H
        ORA L
        JNZ L1
        POP PSW
        INR A
        CPI FFH
        JNZ L2
        HLT
```