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Research paper

Genetic algorithms modules in e-lessons system " modern learning theories in review"

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Abstract

This paper presents e-lessons system which can generate multiple e-Learning modules (eLMs) based on selected modern theories of learning. The considered case study in this paper is Genetic Algorithms topics. In this paper , methodology of tutorial was considered it is a traditional method and suitable to the scope of this research work. Due to the e-lessons system mechanism , two projects have been accomplished , the first for instructor while the second for candidate. Database was used as a tool to save submission of instructor. The e-lessons system in this research work is aimed at achieving maximization of instructional outcomes , continuous interaction between candidate and computer , effective learning aspects as well as realizing the meaningful learning. In order to achieve the previous goals some selected theories of learning were considered (Ausubel , Spiro , Tolman , Skinner and Landa theories). Tools used to implement the system are , Tutorial methodology of e-Learning , visual programming , Database and multimedia components. The case study of the research is selected topics of Genetic Algorithm. Results and Conclusion ensured the benefits for instructional outcomes in teaching Genetic Algorithms via e Learning depends on systematic e-lessons System. The Genetic Algorithms in the case study realized the desired goals.

Keywords: *Genetic Algorithms; E-Learning Modules (Elms); Tutorial Methodology; E-Lessons.*

1. Introduction

The Idea of this research is to create a systematic e-lessons system which can generate eLMs adaptive with Genetic Algorithm Topics. Therefore , in order to achieve the target of this work , the author plans to a systematic work , means there is a theory/theories of learning , selected theories which are adaptive with mechanism of tutorial methodology in e-learning, multimedia in visual programming and Database to realize the target of e-lessons System as well as with topics would be selected to the above target. All those details would be briefly expressed via items of this research. More details have been focused in the next sections.

2. Objective of research

1) Developing an e-lessons system based on selected theories of learning to be adaptive with topics of Genetic Algorithms using tutorial methodology.
2) Testing the desired genetic algorithms topics in e-lessons system, at least one complete e-lesson unit using visual programming, multimedia technique , database to achieve the needful target of e-lessons system.

3. Theoretical approach

Multiple subjects deal with the research work: e-lessons system , Tutorial methodology in e-Learning , Genetic Algorithms , theories of learning and Instructional Computer.

i) E-lessons Systems: The concept of e-lessons system deals with developing a main project, this project can introduce several eLMs for any given topic by the instructor. Two sub-projects deal with the main project, the first project is assigned to the instructor who submits his material (text, exam, pictures, exercise, voice files, video clip files, all multimedia files, etc.) according to the instructions of the system. All the entry material would be saved and transformed into the second project (student project). Then it would be reconstructed via student's project. The student will find eLMs in his project (second project) according to the type of eLM. However database is depended to save and read information.

ii) Definitions of The Terms Deals With Instructional Computer

a) Computer – Based Education (CBE) and Computer – Based Instruction (CBI): are the broadest terms and can refer to virtually any kind of computer use in educational settings, including drill and practice, tutorials, simulations, instructional management, supplementary exercises, programming, database development, writing using word processors, and other applications. Either these terms may refer to stand – alone computer learning activities or to computer activities, which reinforce material, introduced and taught by teachers.

b) Computer – Assisted Instruction (CAI) is a narrower term and most often refers to drill – and – practice, tutorial, or simulation activities offered either by themselves or as supplements to traditional, teacher directed instruction.

c) Computer – Managed Instruction (CMI) can refer either to the use of computers by school staff to organize student data and make instructional decisions or to activities, in which the computer evaluates students' test performance, guides

them to appropriate instructional resources, and keeps records of their progress. However There are many other terms deal with same definitions : Computer - Enriched Instruction (CEI) , Computer-aided assessment and learning des , Computer Based Learning and Computer based training (CBT)

iii) Genetic Algorithms

This paper covers some selected topics of Genetic Algorithms (fundamentals), thus they will displayed briefly. It is an umbrella term used to describe computer-based problem solving systems, which use computational models of evolutionary processes as key elements in their design and implementation.

We have always looked up to Nature for inspiration

Birds -> aircraft

The GA Problem-Solving Model

1) Create a number of tentative solutions.
2) Choose one or more of these, alter them to create new solutions. Allow more options for better ones.
3) Discard some of the solutions.
4) Repeat

Over a period, solution quality will improve!

GA for classroom scheduling....

Create schedules with random assignment of teachers to classes

Evaluate each schedule; select schedules with bias towards better ones.

Alter them: change a teacher of a subject, swap two teachers, etc.

Repeat

Components of a GA

- A problem to be solved (obviously)
- Encoding the solution as a chromosome
- Population management
- Evaluation function
- Selection of parents
- How to alter the solutions
- Crossover and Mutation

Sample Code of GA

```
Time t = 0;
init population P(t);
Evaluate P(t);
While (Not met Termination Criteria){
q = select from P (t);
Alter q; // cross over and mutation
P (t+1) = revise P (t) with q;
Evaluate P (t+1);
t = t+1;
}
```

iv) Selected Theories of Learning Deal with Developing the Authoring System

Due to the fundamentals of eLMs some selected theories of learning must be considered during developing eLMs. Thus three modern theories deal with using technology media like computer were considered , they are :

a) Ausubel (subsumption theory): A Primary process of learning is subsumption in which new material is related to relevant idea in the existing cognitive structure.
b) Cognitive Flexibility Theory (R.Spiro) ,this theory build upon(Brner,Ausubel , Piaget) it is formulated to support interactive technology (e.g computer ,videodisc)
c) Algo-Heuristic Theory (L.Landa) , with respect of sequencing instruction Landa proposed number of strategies ‘snowball ”method , cognitive activities can be analysed into operations of algorithms ,it gives the expert main role to analyse instructional material
d) Operant Conditioning (B. F. Skinner), This theory is based upon the

Idea that learning is a function of change in overt behavior. Changes in behavior are the result of an individuals' response to events (stimuli) that occur in the environment.

A response produces a consequence such as defining a word, hitting a ball or solving a math problem. When particular Stimulus – Response (S – R) pattern is reinforced (rewarded), the individual is conditioned to respond. This operant conditioning characteristic distinguishes it from previous forms of behaviorism.

Reinforcement is the key element in this theory

e- Sign Learning (E.Tolman), This learning theory is also called purposive behaviorism and is considered as a bridge between behaviorism and cognitive theories.

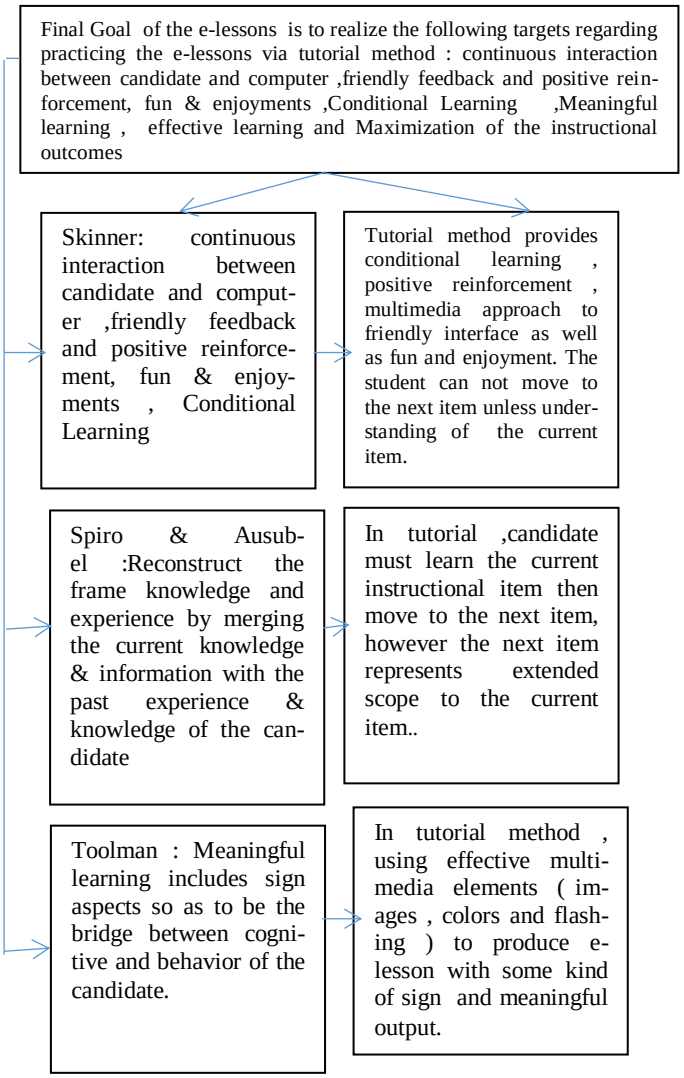
According to this theory learning by organism is acquired through meaningfully pursuing of sign to a goal.

v) Tutorial Methodology in e learning: The diagram in Figure1 describes mechanism of tutorial method.

4. Mechanism of tutorial lessons via learning theories

Due to aim of research and mechanism of tutorial method , many goals must be realized when practicing tutorial modules of Genetic Algorithms topics. Figure 1 , explains mechanism of tutorial method. Figure 2, represents Block Diagram of e-Lessons System for Genetic Algorithm Modules. Figure 2 meets mechanism of Figuer1.in Figure2 , two main projects have been accomplished , for instructor and student using visual programming ,database and multimedia.

Below diagram explains Mechanism of Tutorial method to realize requirements of learning theories. However each goal was assigned to suitable theory to be accomplished.



5. The results of print out screens for the proposed system

In the next section some selected print-out screens after testing the e-testing system regarding generating eLMs of Genetic Algorithms topics, figure 3 illustrates the contents of screens . However the selected topics represent fundamentals of Genetic Algorithms. Visual programing was used to implement the systems with traditional Database to save submission of the instructor then read the saved data by student project. Due to literatures of e-Learning methods , Tutorial methodology includes 3 items in the individual eLM. Thus one sub-item would be presented as case study which includes text presentation and related question with multiple choices. Also the suitable feedback was presented for the incorrect answer as proper feedback and reinforcement for the correct answer.

As per the pair of four print-out screens, in sequence the first four screen of the instructor project (after submission information of Genetic Algorithm) by tutorial method. In the right the corresponding four screens of the student project. However the student is the final user who will use the eLM of Genetic algorithm by tutorial approach. While the instructor is the first user who submits his instructional material according to instructions of the authoring system

6. Conclusion & future work

The author summarized conclusion of this paper as following:

i) Using e-lessons System for eLMs realize multiple advantages for both instructor as well as student. Whenever using systematic methodology like tutorial and considering selected confident theories of learning , it is expected to achieve target of teaching/learning process of Genetic Algorithm. eLMs which were generated by e-lessons system can present ideal environment for meaningful learning , effective learning , continuous interaction between candidate with computer and achieving maximization of instructional outcomes accordingly.

ii) ELMS which would be generated by the e-lessons system , they are expected to be friendly learning tool to the student. Continues interaction between student and computer provides enhancement and self-confidence to the student. Student will take the active role in learning process.

iii) Future work could be summarized in developing such effective e-lessons system for multiple topics and via Mobile device not pc. Using similar system in another approaches of e-learning methodology (Drill & Practice, Problem Solving, Intelligent Learning , etc.) , adding layers of security particularly for exam modules and using similar system for Online domain.

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Figure1 , Figure 2 and Figuer3 in the next pages →

FIGURES:

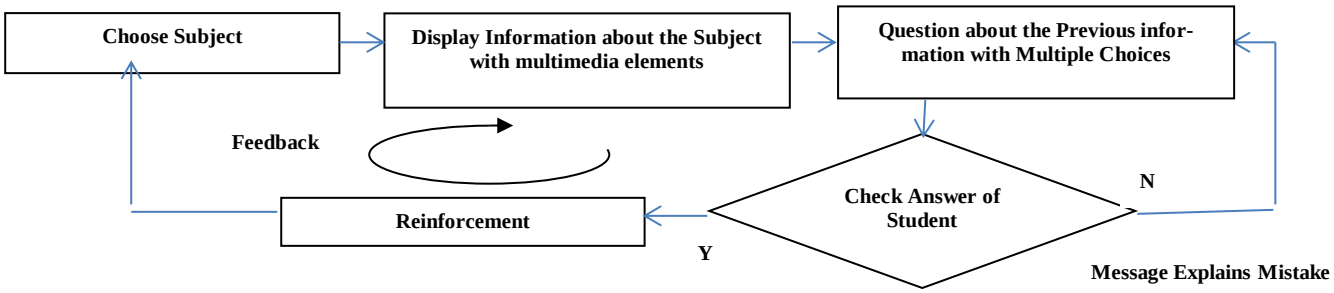


Figure.1: Diagram of Tutorial Method

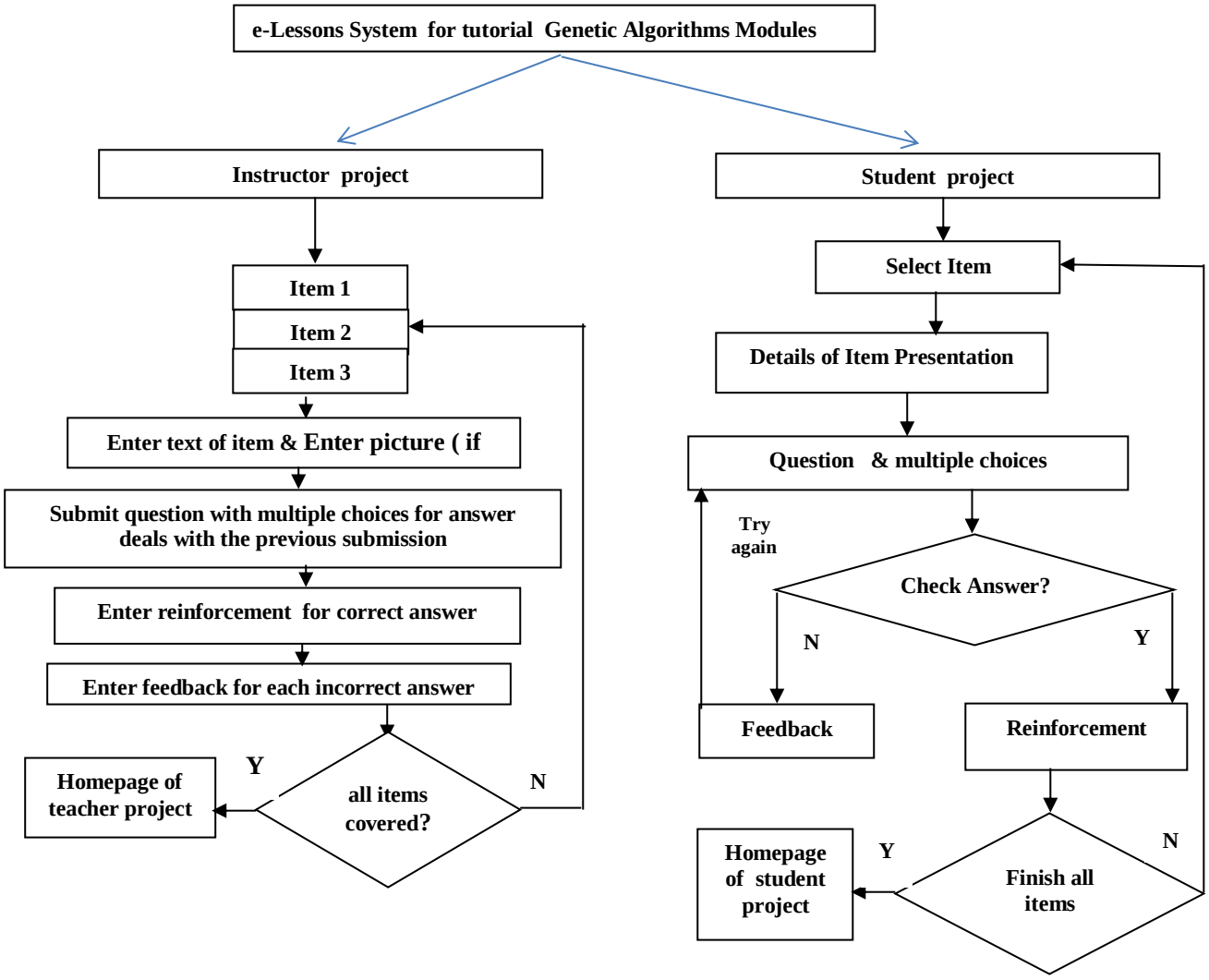
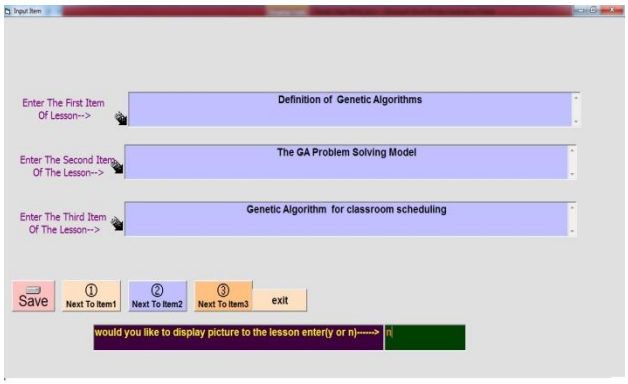
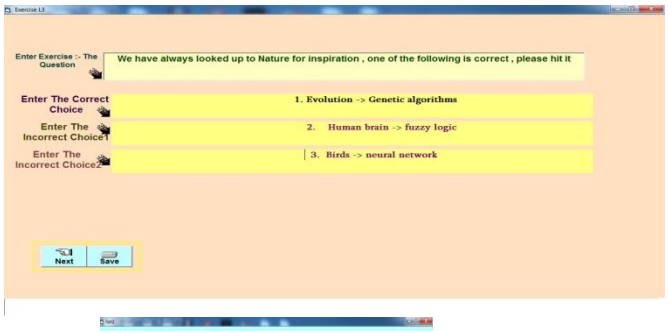
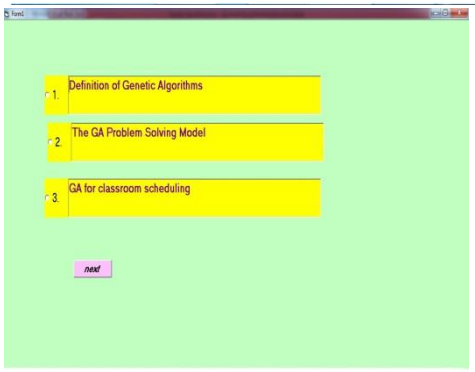
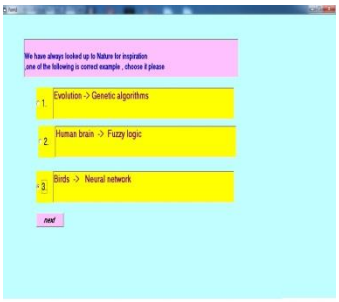


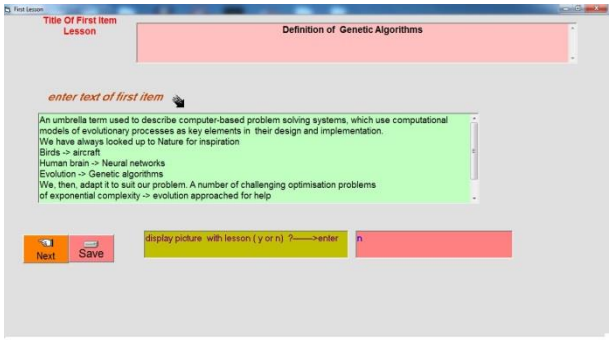
Figure.2: Block Diagram of e-Lessons System for Genetic Algorithm Topics

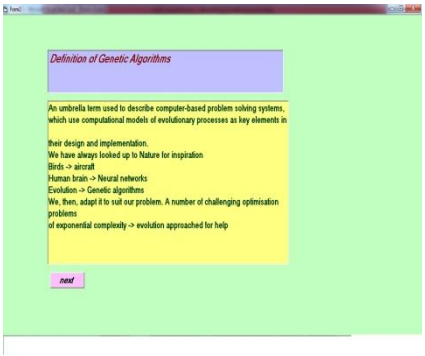












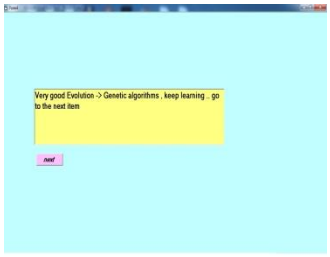


Fig.3 eight print-out screens , 4 screens for instructor project and corresponding 4 screens for student project