Programmed learning

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Programmed learning

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Abstract

Education knowledge-ability and innovative products go hand in hand with developing new abilities to learn. Teacher's personality influences the creative process, which depends on various factors: enthusiastic students willing to learn, i.e. a decisive element in education as well as mastering new creative processes resulting in faster and more efficient grasping new information. Education system effectiveness at the time of advanced technologies, scope of interdisciplinary knowledge as well as simultaneous higher demands for experts in changing spheres of life is becoming hot issues of the day. The world of education follows the same assessment criteria as other branches: success fast as can, cost-benefit ratio, elimination of time and money consuming activities, etc. Programmed learning-teaching process deals with control and currently is becoming almost irreplaceable component of subjects´ curricula. Regardless it has a long past, its history is expressed just in decades: it encompasses methodology, teaching aids, broad spectrum of branches, therefore experts from various disciplines try to push its development.
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1. Programmed learning history

1.1. Origins of programmed---fractionized learning

Having examined the term fractionized learning considering its content, we trace back to Herbert's element-association doctrine or even earlier, however auto-instructions being supported by machines is no more than couple of decades old. The term "language machines" first appeared in The Workshop by Kees Boeke, the Dutch, who became famous for his educational ideas, similar to Dewey and Decroly. Theory of programmed learning as a professional discipline has been known for more than 50 years. The idea was born in the U.S.A. and the first teaching machines started their development and boom. Pressey, Skinner, Crowder, founding fathers, as well as representatives of further generation have become known as programmed learning popularizers.

Russia fully accepted that idea as an optimum learning control method. It was being developed, improved and enhanced resulting from extensive knowledge, particularly in pedagogy, psychology, cybernetics, theory of information and mathematical logic. Considering programming theory, Great Britain and Germany are recognized

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significant centers. This discipline started progress a couple of years later in other European countries and former Czechoslovakia; however, this fact benefited from advanced cybernetics and various logic-mathematical disciplines which could be preferably utilized.

Germany became respectable due to strong vital international information and knowledge exchange in this field; it performed highly advanced mathematical-cybernetic methods, well-developed programmed learning model concept as well as comparatively fast practical further utilization.

1.2. United States of America

L. Pressey's work arose out of research in the field of educational methods, assessment of results and similar activities, however, the work dating from after World War II originated predominantly in laboratories for animal conditioning. Both are essentially founded on the idea of element association and extension of the theory of trial-and-error.

In 1954, B. F. Skinner, a professor of psychology from Harvard University attracted attention by his lecture The Science of Learning and the Art of Teaching. He accepts and defends traditional American psychology based on behavior approach. He studied behavior as well as organism behavior control. By him, the learner's behavior is shaped by the program and he follows the model: S-R-R (**stimulus-response-reinforcement).**

Crowder's branching program concept consists in student's response and immediate feedback provided by a control system. The response does not work as a condition of learning (Skinner); it works as a condition control. Crowder approach considers more extensive differences of learners.

2. Core and programmed learning content

Every area of interest including pedagogy calls for higher work achievement. We can reach the goal through various technological, mechanical and automation means. More efficient teaching techniques result in better knowledge ability, early specialization and diversification. Students prefer active part; they are offered self-pacing and more independent autonomous working, see [3].

Models are used in order to specify educational goals and their compartmentation. The model is understood as a particular structure used for well-arranged presentation of complicated items or processes. Having assembled models - learning programs – two significant psychic learning processes are focused by L.N.Landa.

I. algorithm models: to stop in order to explain logical structure of a studied problem. Algorithm model specifies exactly appropriate procedure.

II. stochastic models are the others not having algorithm characteristics or algorithm which cannot be exactly specified. The task is solved using the most probable procedure.

2.1. What is algorithm?

Algorithm as an expression may not be specified in programmed learning as an ultimate idea. It is understood as optimum logical system in order to study a particular problem, area or course. Algorithm belongs to basic mathematical categories. In fact, it is a rule or a calculation method. The explanation of the term is not unambiguous. The word derives from the name of the mathematician, Mohammed ibn-Musa al-Khwarizmi, whose work is the likely source for the word *algebra* as well. The simplest algorithms are rules which are applied to basic mathematical operations in decimal numeration system, e.g. total of two multiple-digit numbers is itemized into sequence of operations when a person watches just two relevant digits of summands. Programmed learning is a method focused on presenting knowledge fast as can; it is a method of designing a reproducible sequence of instructional events to produce a measurable and consistent effect on behavior of each and every acceptable learner.

3. Principles of programmed learning

The basic requirement consists in breaking study material into small steps and immediate feedback and confirmation of every step consisting of information presentation, question and learner's response.

The technique is based on the principle that learner knows immediately whether he committed error or not and he progresses following the program. Individual steps are arranged in logical sequences of material called **program.**

3.1. Programmed learning principles

- Principle of small steps
- Principle of active responding
- Principle of reinforcement

- Principle of self-pacing
- Principle of evaluation and program revision

Programmed learning principles, methods, operation arrangements vary; however there are outlined two basic methods of programming: Skinner linear programming and Crowder branch programming.

3.2. Skinner linear programming

The linear style of programming was developed by B. F. Skinner. Linear Skinner program consists of small steps which every learner is able to pass without troubles. By Skinner, 95 % correct answers means a successful program.

First, the study material is broken into small information steps, then the information is presented – learner answers – correct answer is offered, and the process reiterates.

3.3. Principles of linear programming

1. Learners read instructions in the same hierarchical order.
2. Skinner linear program calls for the learner's original response.
    - Every question requires active response – every blank must be filled in.
    - Active response is preferable because:
        - recall is more efficient than recognition,
        - response results in learning, therefore learners should not be offered incorrect choice.
3. Small step is typical for every linear program.
    - response results in learning, therefore every step must be small enough to expect correct answers and prevent incorrect answers,
    - too many incorrect answers do not motivate learners, correct answers are positive stimuli.
4. S. Pressey justifies retrieval choice linear programming as follows:
    - Numerosity law: Learner's response is sometimes not correct; however, finally he makes a correct choice: we can assume that correct answers prevail
    - Novelty law: incorrect answers are unimportant: the correct answer is always the last one which the learner remembers.

3.4. Crowder branch programming

The branching or intrinsic method of programming was originated by N. A. Crowder. His method consists in three principles: principle of exposition, principle of diagnosis, principle of remediation, i.e. presenting information, asking question and presenting multiple choice answer (4 – 5); one is correct, the others are false: the incorrect answers are not prima facie.

The learner progresses in the main stream from number 1 to number 2 then 3, etc. If he makes a wrong choice, he is led to remedial item wherein is given some more help in understanding the concept and in solving the solution by

a better logic. He will then be directed to the original frame so that he can read it again and answer it correctly in the light of the remedial material he has received: the learner goes through the same frame twice. Comparing to linear programming there is a difference in alternatives which "always go somewhere"(D.Cramm).

What are advantages and limitations of branching program?

Advantages:

Based on traditional tutorial method, individualized instruction, multiple choice questions, freedom to choose path, alertness of learners, detection and correction of errors, development of discrimination and creativity, larger frame, useful in concept learning, controlled material, psychological and social motivation, easier to develop frames, teaching and instruction, programmed text.

Limitations:

Guessing, difficulty in multiple choice answers, difficulty in arranging the branching sequences, unfeasibility of infinite branching, inability to control the student, emphasis on remediation, no sequence of pages, programmer's imagination.

4. Learning process

The processes of learning pay an increasingly important role in our rapidly changing world. The ability or capability to learn is a complex psycho-physiological trait, which develops over a process of learning from certain innate prerequisites for learning. Other determinants that may influence the course and results of learning are e.g.:

- Previous learning experience
- Personal attitude to learning
- Willingness to learn
- Interest in learning
- Influence of superiors (mainly family)
- Influence of fellow—workers

- Applied methods of education
- Teacher – his character and type
- Teaching materials – its character, structure and arrangement
- Conditions under which the instructions is performed
- Etc.

Lucky smiles on those who are well prepared to the best use an opportunity.

This proverb can be definitely applied to the educational process, see [2]. The ability of an adult to learn is affected, in addition to the level of intellectual powers, by creativity, individual specifics of development of psycho-psychological functions, willingness to learn, attitude to learning, etc. However, *willingness to learn* is crucial factor.

It would not be correct to consider the learning as a process limited to the environment of the school or educational institution. In learning,

- Memory
- Person's perception
- Reasoning

- Will
- Feelings
- Motivation

- Character
- Psychology
- Personality,

all this play a part and is developed through learning. Human learning is a very complex and diversified. Sometimes we hear that learning consists of acquisition of knowledge, skills and habits, but this is a very simplified statement. In fact, through learning we

- master our knowledge, skills and habits
- change abilities
- •traits personality
- traits character qualities
- shapes the will, etc.

Learning is understood to be a process in which an organism acquires individual experience; considering processes and mechanisms that take part in learning, they can be divided into perception-motor learning, verbal, conceptual learning and learning how to solve problems.

4.1. From data to knowledge

There are basic terms applied to field of knowledge in general: data, information, knowledge skills, habits.

4.1.1. Data

Data can be characterized as everything able to be monitored through our senses, i.e., all we can feel, taste, see or hear. Data can also be specified as objective facts on events or sequence of attributes. Data are mostly well structured and related to a particular technology. They can be quantitatively assessed

- via expenses, i.e. means we have to spend in order to get them,
- rate, i.e., how fast we get them,
- capacity, i.e. what amount of data is available at particular moment.

Data can also be classified through qualitative indicators. In that case we observe whether the data are available if needed, they follow required demands, the coded information included is understood properly.

4.1.2. Information

Information can also be specified as data both through quantitative and qualitative phenomena. The information is generated from data as 5 C: contextualization, classification, calculation, correction and condensations.
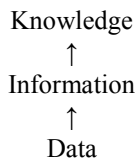
The information value depends on the price we had to pay to obtain the information and personal relation to the information: we do not suffer from shortage of information but from its excess and redundancy. The problem is the user must carry out the selection by him and neither information system nor technology can substitute for him. In order to succeed and select the right one, he must acquire knowledge and information becomes a fundamental building block of knowledge.

4.1.3. Knowledge

Knowledge can be specified as a varying system covering interaction between experience, abilities, facts, relations, values, thoughts and meaning. It can also be specified through the term of information:

$$K = I + x,$$

where K is knowledge, I is information, x is what the information in the brain interacts with; knowledge is always closely related to activities and emotions and human mind: it is a part of routines, processes, practices and standards.

$$
\begin{array}{c}
\text{Knowledge} \\
\uparrow \\
\text{Information} \\
\uparrow \\
\text{Data}
\end{array}
$$

There are several ways how knowledge can be derived from the information: *comparison*, i.e., we compare new information and already familiar knowledge of similar or different situations, *coherence*, i.e., we assess the importance of information due to further decision-making, *inter-linkage*, i.e., we try to find the relation to

knowledge that has already been available, *conversation*, i.e., we try to find out what other individuals guess about the information.

Knowledge is created in human mind and its quality and importance are assessed through activity. Knowledge cannot be stored, transported and expressed via technology. Attempts focused on its externalization resulted in knowledge damage and finally its value declined. Knowledge can be understood as acquired through learning, general experience. These are specific facts, information, terms, theses, rules, laws and other general knowledge.

Skills are more or less complex conscious activities used to fulfill certain tasks and based on knowledge and can be achieved during training.

Habits are automated operations brought to a certain degree of performance. These are the steady-state courses of action that have a motivation element: habits are also incentives of our behavior. In a process of acquiring knowledge, skills and habits, a person develops will as well as character, interests, needs, value systems and abilities, i.e. his whole personality.

5. Conclusion

Mankind has been working with knowledge from beginning to everlasting end is trying to find the way how to manage it. The difference consists in technological and scientific level and maturity of current generations. The volume of information rises undoubtedly fast and we try to find and search for methods and tools that can assist to sort out and systemize the mankind's knowledge. On the other hand, technological level hand in hand with psychology, neurology and genetics makes possible to initiate undreamt-of abilities of human brain.

Education system effectiveness, extensive scope of knowledge as well as simultaneous higher requirements for experts is becoming a world hot issue. Education sphere follows the same evaluation criteria as other branches: success and effectiveness fast as can, maximum work achievement and full use of latest technology. Programmed learning deals with control and therefore becomes an integral part of various subjects: it covers teaching aids, methodology, various branches, professions and experts try to contribute greatly to its further development.

Regardless the fact there has been considerable controversy considering the positives of programmed instruction as the sole method of teaching; many methodologists agree that it contributes to more efficient classroom procedure and supplement conventional teaching methods. Nevertheless, one of the most important conditions to study is the student's will and interest. The teacher may have the discussed topic prepared perfectly, interactively, interestingly; however, without the student's interest and will to understand, practice and master the topic, the result of the educational process would be close to zero.

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