Artificial intelligence in Programmed teaching and learning

DANIMIR MANDIC
University of Belgrade
SERBIA
MIRKO DEJIC
University of Belgrade
SERBIA
EZZADEEN KAMUKA
University 7th april in Libya, Zawiya
Faculty of Education
LIBYA

danimir.mandic@uf.bg.ac.rs http://www.uf.bg.ac.rs

Abstract:
This paper deals with a software based on artificial intelligence prepared for programmed learning. Programmed learning is defined as teaching material classified in carefully planned articles and sequences, from which comes assignment which pupil solves and receives information right away whether he had solved the assignment successfully or made a mistake and encouragement for further work. This way feedback connection from pupil towards teacher is realized. Therefore programmed learning can be used without learning machines, but computer powered by artificial intelligence, can not be without programmed material in it. Intelligent educational software can successfully replace or complement teacher where his abilities are technically or biologically limited. In his model pupil has possibility to choose one among several offered alternative replies which are given in a wider entirety, and give reply that he thinks is true. If he chooses wrong reply, pupil must reinvestigate the complete process of previous work and find out where he had made a mistake, and that helps him in different directing of his further work. In this way independent thinking of pupil and his abilities are revealed more intensively. Very important contribution of branched programme is that it makes possible individualization of teaching and learning process using educational software.

Key-Words programmed learning, artificial intelligence, software, informational technology

1. Introduction

Programmed teaching in a wider sense influences changing of traditional organization of educational institutions, modernization of contents and methods of work in schools, raising quality of human relations in process of educational activity and more active inclusion of pupil in teaching work. The following things have contributed to development and affirmation of today's forms of programmed teaching. Important scientific inventions in the field of electronics and cybernetics, 21-st century psychological knowledge (specially genetic and pedagogical), strong development of modern teaching theory, possibilities of modern inventions application logic in teaching work, artificial intelligence, considerable discoveries achieved to pedagogical science in the field of self education and self teaching. Namely, thanks to these and other objective factors, programmed teaching has gradually been receiving important place in modern school. [1]

It is also worth mentioning that modern inventions in science and technique have contributed to development of educational technology. Today's degree of development of educational technology has helped men to see more precisely its connection with the development of general technology and become convinced how much all that means for man, his learning, his
development, his emancipation and social progress. New educational technology, powered by artificial intelligence, has influence on introducing important changes in organization of educational institutions, contents and methods of teaching activity as well as in relations in institutions that are conducting teaching and education. Here we shall talk about programmed learning and intelligent software in order to indicate their place and role in modern teaching.

2. Reasons for introduction of programmed learning

Programmed learning came from need to define precisely learning content, to fix activities which will enable success, provide conditions and means for that, create favourable psychological climate for acquiring knowledge, its control and development of human capabilities. On the other hand, programmed learning results from teacher's need to know how much and how pupils learns, what are their difficulties and how it is possible, to eliminate them. Pupil himself in the process of programmed teaching is able to learn things he is interested in, in accordance with his individual abilities, his speed, with constant encouragements in conditions for return connection from pupil to teacher and for work where success is guaranteed.

In programmed teaching the whole teaching material is completely known, out of that whole is taken what makes its essence, and then is translated into the language understandable to pupil, then material is organized and systemized, make possibility is made for pupil to start learning from the point he had previously finished, care is taken about firm logic connection of all parts of a whole which is presented, programmed parts are formed in small closed, wholes (the connection of which, with bigger whole is evident) and based on it (assignments and problems are formed that pupil has to solve. This is achieved by writing articles and sequences (a sequence consists of several articles). When programming articles care is taken that they have information (what is being transferred to pupil), assignment and its solving, feedback information, the assignments being given so that solving of first assignment is condition to solve second and so on, and this provides pupil's gradual advancement. In that way precise planning of teaching material is achieved, its dosing and at the same time care is taken of interests and possibilities of pupil, constant control of advancement is realized, work obligations are gradually increased, general development of learner is systematically followed, spontaneous thinking activity of pupil provided. Conditions are made for raising maximum success with minimum efforts and there are instruments and possibilities for adequate evaluation of young people work. It is also achieved therewith that learning becomes entertaining to a certain degree and it engages pupils attention more strongly. The fact that programmed teaching takes care about intelligence, knowledge, level of reading skill of pupils, results of diagnostic tests and teacher's grade, also contributes to its quality. In programmed teaching, as already stated, and information is usually given, a problem stated that pupil should solve, after that pupil gives his solution, does the operation (in case it is not automatically solved) to see the solution given by programmer, does comparison, eventual corrections and completions, gets a grade and instructions for further work. Thus dynamized learning is suitable to psychological characteristics of child and for that reason he is tireless in work in his first contacts with programmed teaching. [1] Programmed learning is defined as teaching material classified in carefully planned articles and sequences, from which comes assignment which pupil solves and receives information right away whether he had solved the assignment successfully or made a mistake and encouragement for further work. This way feedback connection from pupil towards teacher is realized. Computer is a technical device by means of which programmed material is presented, its bigger part or smaller whole given in sequences that enable pupil to come to problem, give his reply, register what he had replied and send feedback information. Therefore programmed learning can be without learning machines, but learning machine, as we had seen earlier, can not be without programmed material in it. Computer powered by artificial intelligence can successfully replace or complement teacher where his abilities are technically or biologically limited. B.P. Skinner used some of the principles which Thorndike noticed, in his researches at Harvard, enlarged bases of earlier researches and came to important conclusions in the field of learning theory. He has specially
diligently studied problem of stimulus-reactions and encouragement in learning, and that meant a lot for programmed learning. According to Skinner, learning consists of shaping human behaviour. [6] By constant encouragements the desired forms of behaviour are obtained, on one side, and gradual weakening and excluding such forms of behaviour which are not desirable, on the other side. He has given linear programmes. American psychologist A.F. Krauder has studied and worked out branched programme system which makes possible to dynamize more communication in learning process and to rule more securely pupils activities. In his model pupil has possibility to choose one among several offered alternative replies which are given in a wider entirety, and or give reply that he thinks is true. If he chooses wrong reply, pupil must reinvestigate the complete process of previous work and find out where he had made a mistake, and that helps him in different directing of his further work. Therefore, branched programme instructs pupil to additional steps which he can see, thanks to additional explanations of by reinvestigating situation, where he made mistakes, to go on faster in further work, gain wider knowledge and has better insights into situation and learning contents. In this way independent thinking of pupil and his abilities are revieled more intensively [6]. Very important contribution of branched programme is that it makes possible individualization of teaching and learning process. While it is neglected with Skinner how is pupil instructed to come to the right reply, with Krauder it is stated as one of impportant factors of programme realization and implementation of learning process. Programmed learning is sometimes called autoinstruction, automatic instruction or selfinstruction because function of teacher in giving information is reduced to minimum or, in some cases, it is not evident at all. It is the reason why „pedagogical fashionable persons“ give brave statement that modern computers will replace teacher. However, researches have shown that learning machines are only one (truly very improved) teaching aid, but they do not replace teacher but influence gradual change of his function, to create new possibilities for learning and advancement of teaching. Therefore, it is a false dilemma „machines or man“, and real solution is „machines in hands of man“.

3. How is programmed teaching conducted

We have already said that programmed teaching can be conducted in two ways: by means of programmes textbooks or materials and learning machines. Of course, there is also semiprogrammed teaching, but we shall not talk about it here. Programmed textbooks are rather frequent in our time and they are more used than artificial intelligence. Textbook is programmed in such a way that teaching material of one subject is divided into logic entities, those entities are then subdivided into smaller parts and formulated the form of small problems, assignments, questions with multiple choice, open questions, etc. and classified in sequences. Here, it is starting from easy questions which pupils can answer. Answer can be indicated by context or come from answers we had given earlier. In a programmed textbook usually two thirds of a page are used for stating problms, formulating assignments and presenting suppositions for their solving and for registering answer or given solution. In the last third correct answer is given. [3] When learning pupil covers part of the page of textbook where answer is given, he tries to answer the question by himself and then uncovers the answer to compare it with the answer he has given. Here the procedure is from easier to more difficult, from known towards unknown, from more simple to more complicated, care is taken to connect new ideas with the old ones and with what had been learnt and to provide further more secure advancement in work. Sometimes at the end of some entity exercises are given, short text or „quiz“ questions with the aim that pupil can check his knowing of such entity and assure conditions for learning of what is following. Programmed textbook has advantage over ler arning machines as follows: preparing material does not require big efforts, programming and printing is not exppnsive, use is simple, manipulating is very simplified, pupils can take home such textbooks and learn when they wish, and feenr keep it after fini shing work. Programmed textbook, specially if it is not programmed adequately and used, in accordance with the principles, has its disadvantages as well. Thus, for example, teaching material can be reduced to a stereotype, learning formalized and everything done can be turned into dominaitely routine operations. Besides, pupil cam „return himself“ if he
first looks at solution of assignment, and then does the assignment himself. Programmed textbook, same as any programmed material, is worth as much as content, methodic and general pedagogic sides of the programmed material are worthy. That is why programmed textbook is required to fulfill some general requests of teaching organization and conducting: to make possibility for each pupil to learn at his own speed, to plan material having in mind basic didactic-methodic requirements, that articles and sequences logically follow one from the other, that pupil can learn by himself and control himself, that there are corresponding instructions and additional assignments which are necessary for more independent work of pupil and for his selfcontrol. When these sad other requirements are met, which we were talking about earlier, then programmed textbook becomes source of information and, if necessary, additional explanations, it gives tasks which pupil solves, make possibility for him to control himself and to advance in his work. Therewith programmed textbook meets basic requirements included in learning process.

Learning machines are not new teaching aids, although those we possess nowadays are much different from those that appeared in the twenties. Sidney Pressy invented a simple manual machine (according to some sources 1920, and others 1926) for learning and evaluation, which was programmed in such a way that pupil gets a candy for each correct answer. This machine had possibilities to ask a question, give alternative replies and choose the correct reply. Teaching machine of this kind does not conduct teaching by itself, but makes possible learning thanks to programmed material, which is bases for learning. It offers simple and understandable learning material and, if it is electronic or based on computer, in addition to giving automatic instructions and information, has great ability to adjust programmed articles and sequences to the needs and spiritual abilities of pupils. [6] Computer teaching machine has possibility to have instructional dialogue with pupil and to give him all needed instructions and additional information in work to be able to advance in his work.

4. Advantages and disadvantages of programmed teaching

The newest researches of effects given by programmed teaching have shown that it is not allmighty, that it can not solve numerous problems of modern teaching and education, and that it would not have such pretensions, or it ever had them. Some experts of teaching in the USA have claimed that programmed teaching, by giving possibility to pupil for self education and selfevaluation, will push out teacher and make him, to a certain degree, unneeded, and it will make revolution in teaching and make pupil as independent creator. Researches have shown that programmed teaching, thanks to its technical base and the function it has, changes role of teacher, but can not replace him. Teacher is, in conditions of well thought out organized programmed teaching, mostly organizer, planner, somebody who directs, researcher, verificator of pupil's work and educator, not a walking and speaking textbook and living encyclopedia. Those who look at programmed teaching results with great optimism claim that it assures scientific organization of pedagogical work, satisfies logic of learning, opens new learning possibilities, stimulates pupil's activity, provides advancement at his own speed, makes teaching more attractive, provides economy and efficiency of teaching and therewith belongs to such kind of teaching which is most suitable to needs and interests of young, people. The newest researches, although do not deny attractiveness and efficiency of programmed teaching, indicate that here also, in appraisals, more steadiness and flexibility should be shown. Still, programmed teaching nowadays is not fashion any more, but one of serious scientific problems of...
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Present and future education. It has already found its implementation and taken important place in all kinds of schools in one part of the world [5]. Some protagonists of programmed teaching dared to say that it efficiently solves problems which were brought by „knowledge explosion”, technological revolution and cybernetics. However, the truth is that programmed teaching only partially solves and helps to lessen some of the problems our school, society and time in which we live are burdened with. It gives best results when combined with other forms of teaching. Advancement in work as well as more active participation in learning process. Thanks to this, it is possible to respect didactic principles in teaching more consistently, more secure control of teacher and pupils work. This teaching rather well satisfies needs and interests of young people, it allows advancement in accordance with their strengths and abilities; there are some general conditions for full motivation of pupils (specially by feedback information), acquiring of selfconfidence and responsibility is made possible; good conditions are made for selfeducation and for forming conviction with pupils that on their work depends what they will be in future. All this, no doubt, contributes to rationalization and intensification of teaching. Without great results of empirical researches it can be concluded that programmed teaching frees teacher, to a certain degree, of routine teaching and some drills, tutorship, correcting of tests and some homeworks; he has more possibilities to advance professionally, to do creative work, research in teaching, solve educational problems, realize educational work programmes and to be more socially engaged in his community. In this way teacher has more time to plan work for a longer period, to do research in the work process, bring into it necessary innovations and enrich it with his creativity. Researches about advancement of pupils in learning definitely show that it, among other things, depends on conditions for learning, quality of learning and on the person who learns. Generally speaking, researches show, that a well done programme, logically composed articles and sequences, give good results both in teaching that is dominantly programmed and in situations when programmed teaching complements other kinds of teaching. [4].

Researches have also shown, that pupils in the worst case, learn as much teaching material as they would learn with other kinds of teaching, provided they spare time in the process of programmed teaching and enjoy more in learning programmed materials. Teachers as well become convinced that programmed teaching when connected with other kinds of teaching is an attractive and useful innovation. They offer resistance only when all advantages of programmed teaching are not clear to them and when they are not trained to conduct it. If importance of programmed teaching is overstressed, if it becomes dominant, its own aim, if programme is too rigidly stated and formalistically realized it can also have negative consequences. They are, among others, the following: planning of work is too much detailed and formalized, it is lived in illusion that perfection is achieved therewith; universal recipe is given for learning, then mechanical learning is encouraged to a certain extent because pupil is not able to see the whole road along which he comes to knowledge; sometimes all individualized manners of learning are not evident enough; there is fear that learning might be turned into specific sort of drill; there is danger that degree of being informed becomes more important than development of creative mental abilities, where creativity might be sacrificed for routine; some kinds of programmes, such as linear, may, under certain conditions, cause boredom, there is danger of automatization and mechanization of teaching material and learning presentation; in some cases, material side of teaching is overstressed; educational effects are not used sufficiently which it is offering and therewith unity of education and teaching is disbalanced. Besides, programmed teaching sometimes pushes out collective forms of work; it is more difficult to be conducted with children in beginning grades (although it gives higher effects with children of younger age than of older age); it does not give, at least up to now, not even similar results in all teaching subjects; it is difficult to provide integrity of various subjects knowledge; to a certain extent it lessens possibility of cooperation and mutual help among pupils, while in some cases it unnecessarily exclude teacher from activities where he is needed. On the other hand, for composing, verification and implementation of programme a lot of effort is necessary, as well as material investments and pedagogically qualified personnel, and it is difficult to provide all this. For that reason many programmes, which are criticized
now, are not composed professionally enough, they are not tested in practice by authorized experts. Anyway, programmed teaching is still relatively new, still not studied sufficiently and, therefore many critical remarks should be taken conditionally, same as some results it had shown should be taken conditionally. It is sure that all weaknesses of programmed teaching, we have been talking about so far, will not be shown in practice if it is organized professionally, logically brought into connection with other forms of teaching and learning and reduced to real possibility limits. Learning machine will not find the way by itself how to react in situations which had not been anticipated and will not think instead of methodologist what he himself had not thought about or formulated incorrectly. In order that a machine can operate, exact instructions are needed how to act in various situations, analgorithm of acting is needed". [6]. For that reason methodic and pedagogical training of teacher is more important when using programmed textbook or programmed machine than when contents and methodic instructions for teacher are written to realize them by himself. Pedagogical power of machine is as great as pedagogical wisdom of its programmer.

5. Conclusion

Programmed teaching is becoming more and more popular in some cities (Belgrade and others), considerable tests have been carried out about possibilities of its application in teaching certain subjects (specially exact sciencies), a lot of literature has been written and translated, some programmed materials have been published and seminars organized in the field of programmed learning. Some schools (mostly military) have already provided resources for programmed learning, started with work, while preliminary researches show that programmed teaching is accepted by pupils and teachers, that it brings in refreshment in educational work and gives starting results worthy of attention. Since learning machines are expensive teaching aids, with us, so far, programmed textbooks and materials had been used, but it is realistic to suppose that in future those teaching machines will be used which prove their efficiencies, after experimental verification. Naturally, learning machines will be used depending on how and how much they will be technically improved. Further development of programmed teaching in the world will have influence on the use of learning machines, specially because some sorts of programmed teaching are in crisis in last years. Speed in the way of solving education crisis will also influence further courses of programmed teaching. Programmed teaching had its rises and stagnations. Some people think that programmed teaching is outgrown. The greatest contribution to individualized teaching quality have been given by computers and programmed teaching, although many had claimed that programmed teaching had been outgrown. In the meantime, however, programmed teaching succeeds to survive, if not to advance, thanks to programmed textbooks of linear and branched programmes. In our opinion improved intelligent software for programmed teaching have a future and it will be probably more and more popular.

References: