



Problem-Based Teaching vs. Programmed Teaching: Challenges for the Future of Education

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1. Introduction

The goal of contemporary curriculum is to prepare students for efficient and lifelong learning, as well as to ensure them to acquire procedural knowledge and essential competences. Problem-based teaching and programmed teaching are teaching forms or didactic systems which have the qualities that can considerably help the realization of the above mentioned educational goals. Problem Based Learning (PBL) has been referred to as some of the most powerful and innovative learning environments today. It has gained a reputation of producing students with comprehensive abilities and competences, also preparing them for successful participation in different life situations. PBL has also been widely implemented in education systems worldwide because it is perceived as a pedagogical strategy which combines theoretical subject knowledge with practical skills [1, 13, 15]. It is defined as a learning philosophy and a set of learning principles [7].

The programmed instruction movement was born as a radical reconstruction of the traditional procedures for teaching [11]. Programmed teaching refers to the technology that was invented by the behaviourist B. F. Skinner to improve teaching. It is based on his theory of verbal behaviour as a means to accelerate and increase conventional educational learning. Programmed instruction is a form of teaching that provides students with small, discrete increments of instruction plus immediate reinforcement for correct responses [12], immediate feedback to students. A small switch could be set so that the device would not move from the current question until the student answered correctly [10]. Feedback can be arranged in many different ways [8]. Programmed instruction has variously developed through the history [5, 10, 11].

2. Problem based teaching and learning – advantages and disadvantages

PBL is characterised by an enquiry process where problems – mostly from real and complex situations – are formulated and drive the whole learning process. Learning through PBL promotes critical thinking, self-learning skills, lifelong learning, self-achievement, self-regulation, self-efficacy, communication skills and interpersonal skills for students. It also increases students' interest in a school subject [17, 3, 4, 9]. Activity-based learning is a central part of the problem-based teaching process and requires the activities involving research, decision-making and writing [7]. This can motivate students and give them the opportunity to acquire deeper insights. The assessment methods in the problem based teaching must be compatible with the learning process objectives. This means progress testing in order to establish the individual's knowledge and testing for competences rather than for isolated factual knowledge [7].

The roots of PBL can be traced to the progressive movement, especially to Dewey's [2] belief that teaching should appeal to students' natural instincts to investigate and create. A theoretical basis for improving PB teaching is provided by findings from cognitive psychology. According to Glaser [6], learning is a constructive and not a receptive process, cognitive processes called metacognition affect the use of knowledge, and social and contextual factors affect learning.

A seven jump approach to the problem based teaching and learning, according to Schmidt and Moust, [14] ranges from clarifying unknown terms and concepts in the problem description and definition to sharing findings with a group and trying to integrate the acquired knowledge into a comprehensive explanation of the phenomena. The problem based teaching and learning, besides their advantages, have some disadvantages [Table 1].

Table 1. Advantages and disadvantages of problem-based teaching

PROBLEM BASED TEACHING	
Advantages	Disadvantages
Students are the active participants of their education	Students might not be in the best position to determine the importance of resources
It motivates students for learning	Students might get lost in problem definitions
It enhances students' problem solving skills and helps them face with practical life problems	It is preparation-demanding for teachers
It develops deeper understanding, critical thinking and development of different skills	It requires a lot of different resources which can be expensive
It develops students' responsibility for learning	It is time-consuming



3. Programmed teaching and learning – advantages and disadvantages

Much research has suggested that programmed instruction, despite certain disadvantages [Table 2], is superior to conventional teaching practices in the learning promotion. Other studies have indicated that it produces similar or inferior learning when compared to traditional approaches [8]. Skinner [16] emphasized the importance of feedback in instruction, describing its function as shaping and maintaining the learner's appropriate responses. Learning from programmed teaching usually includes: carefully designed course with predefined sequence of units, very small units delivering only a small amount of new information so it is easily understandable (shaping), immediate answers after filling in the missing information (reinforcement), moving onto the next unit based on the correctness of the given answer.

Programmed instruction can be designed to present information to learners in either a linear or a branched (also called intrinsic) model. Linear programmes allow students to advance through the instructional process in a particular order as they provide correct answers. Students are provided with specific pieces of information in a series of frames and asked to recall or apply this information during frequent tests of comprehension. There are various types of linear programmes [5]. Branched programmes involve the use of several possible paths through the sequence of frames, with the so-called remedial frames and remedial loops being included in order to correct misconceptions identified from student responses to individual steps and offer students a variety of paths through a curriculum. For example, if a student misses a multiple choice question s/he could be directed to the previous frame or to whatever information is most appropriate on the basis of his/her response to the questions. There are various types of branched programmes [5].

Table 2. Advantages and disadvantages of programmed teaching

PROGRAMMED TEACHING	
Advantages	Disadvantages
It individualizes learning and develops critical thinking	It limits students in creativity and originality
Students are the active participants of their education	It is appropriate only for independent students
It increases a focus on scientific design and development of instructional materials	It requires a time-consuming preparation of teaching material and teachers are not competent for designing it
In a short period of time students can learn a lot of contents	Only the material that has a logical-mathematical structure can be programmed
It immediately provides the results of knowledge	It restricts student-teacher communication

4. Traditional/problem-based/programmed teaching – comparative analysis

In this part of the paper, we will present the differences between traditional, problem-based and programmed teaching, comparing them via some curriculum dimensions [Table 3].

Table 3. Comparison of traditional, problem-based and programmed teaching

Curriculum element	Traditional teaching	Problem-based teaching	Programmed teaching
Teaching orientation of lessons	Teacher oriented Pre-planned teaching with a rigid structure	Student oriented Pre-planned, but allows unexpected changes	Student oriented Prepared teaching materials (textbooks)
Goal	Cognitive development of students	Holistic development of students Development of different competences	Development of students' independence and of 'learn to learn' competence
Perception of student	<i>Tabula rasa</i>	Human being full of potentials	Human being open to learning
Cognitive focus	Knowledge as a static and fragmented category Replication and reproduction of received knowledge and application in testing situation Learning as a transmission process	Knowledge as a dynamic, holistic and developing category Develops interdisciplinary knowledge, divergent and critical thinking Learning as a transactional process	Knowledge as a dynamic, holistic and developing category Develops interdisciplinary knowledge, divergent and critical thinking Learning as a transactional process
Metacognitive focus	Skills are students' responsibility Impossibility of developing students' strategies	Students develop strategies for their own learning	Students develop strategies for their own learning

Role of the teacher	Directs students' thinking Holds knowledge Lectures, narrates Controls students Evaluates students	Active problem solving Moderates and facilitates the teaching process Develops new skills and supervises the learning progress	Encourages individual, active and autonomous learning Helps students in the achievement of programmed materials
Role of the student	Inert Inactive Waiting to be led	Active learning through experience Evaluates resources and seeks out evidences Explains to each other concepts, theories, and principles	Active learning Searches, learns and applies the new knowledge through his/her own self-test questions which provide immediate feedback
Social forms of learning	Mostly frontal	Mostly collaborative group work or teamwork	Mostly individual
Progression size and duration	Linear progression 45 or 90 min spent on teaching	Spiral progression with its own time Integrated teaching Projects	Linear and branched tasks/materials Individual time for a task accomplishment
Space and organisation	Traditional setting of a classroom and teaching paradigm	Group and teamwork Integrated teaching	Individual space for each student and his/her own materials
Resources and materials	One-dimensional Structured and pre-determined	Multidimensional Creative and different	Completely structured and pre-determined
Assessment and evaluation	Individual assessment Mostly summative evaluation	Group assessment Formative evaluation Self-evaluation	Individual assessment Self, formative and summative evaluation

5. Conclusion

Starting from the fundamental characteristics of problem-based and programmed teaching, their (dis) advantages and their comparative analysis, we can conclude that both programmed and problem-based teaching develop critical thinking which has long been a goal of social studies education, and its importance has been reiterated in documents delineating standards for the social studies [18]. Problem-based teaching and programmed teaching have a potential to produce positive learning environments that are supportive, structured and, most importantly, directed toward training students for independent lifelong learning. Programmed material is recommended for gifted students because it requires independence in their work and allows them to skip familiar contents, but also it can be prepared for students with disabilities as a part of their individualised curriculum. If they were not able to continue to operate because of some problem, this material would allow students to maintain on a certain area and receive the support. Programmed and problem-based teaching is more effective and efficient than traditional instruction.

Based on the comparative analysis in this study and the perceived advantages of such teaching forms, we recommend teacher education faculties to implement the themes of problem-based and programmed teaching in their programmes in order to train future teachers for the high quality implementation of such didactic systems in their future teaching and in order to have competences needed for preparing the materials.

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