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>
<thead>
<tr>
<th>PROBLEM BASED TEACHING</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students are the active participants of their education</td>
<td>Students might not be in the best position to determine the importance of resources</td>
<td></td>
</tr>
<tr>
<td>It motivates students for learning</td>
<td>Students might get lost in problem definitions</td>
<td></td>
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<tr>
<td>It enhances students' problem solving skills and helps them face with practical life problems</td>
<td>It is preparation-demanding for teachers</td>
<td></td>
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<tr>
<td>It develops deeper understanding, critical thinking and development of different skills</td>
<td>It requires a lot of different resources which can be expensive</td>
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<tr>
<td>It develops students’ responsibility for learning</td>
<td>It is time-consuming</td>
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</table>
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>
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<tr>
<th>PROGRAMMED TEACHING</th>
<th>Advantages</th>
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</thead>
<tbody>
<tr>
<td>It individualizes learning and develops critical thinking</td>
<td>It limits students in creativity and originality</td>
<td></td>
</tr>
<tr>
<td>Students are the active participants of their education</td>
<td>It is appropriate only for independent students</td>
<td></td>
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<tr>
<td>It increases a focus on scientific design and development of instructional materials</td>
<td>It requires a time-consuming preparation of teaching material and teachers are not competent for designing it</td>
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<tr>
<td>In a short period of time students can learn a lot of contents</td>
<td>Only the material that has a logical-mathematical structure can be programmed</td>
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<tr>
<td>It immediately provides the results of knowledge</td>
<td>It restricts student-teacher communication</td>
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</tr>
</tbody>
</table>

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

References


