Second Chance in Mathematics Education

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Abstract

The purpose of this paper is to present a mathematics curriculum developed in Romania for school drop-outs as part of a joint initiative of the Romanian Ministry of Education and Research and of the European Commission, "The Second Chance Project." The concept of the Second Chance math education will be pointed out by comparing it with the math education provided through compulsory secondary education in Romania.

The intention of this paper is to share ways of 'doing' mathematics education for a different target group (elder students with social problems) then the usual one. Finally, this different kind of approach to mathematics is a possible premise for decreasing the dropout rate. The teacher's role is to engage students in learning mathematics and provide learning experiences adapted to specific conditions and individual needs through which students may construct the understanding of the subject.

1. Introduction - History of the Second Chance program in Romania

The Second Chance program started in its experimental phase in October 1999, within a partnership between "Centrul Educaţia 2000+" (Center Education 2000+) and the Romanian Ministry of Education. It was, at that time, an innovative programme for fighting against social and professional exclusion of young people who -- for different reasons -- couldn't complete compulsory education (8 years at that time) and couldn't achieve the necessary competences for a job. According to the 2001 Annual Report of World Vision Romania, "*20% of Romanian children have never been to school or skipped school before grade four. Children in villages are more threatened by this danger. Lack of jobs, money, education and interest within families are root causes for school dropout. The number of children abandoning school across all grades could be as high as 35%.*" The educational system had no formal alternative for young people that exceeded the legal age for attending 'day classes', so there was a high risk of these young drop-outs becoming future illiterate and unemployed people struggling with severe poverty.

The target group of this experimental programme was represented by young people aged 14-25 years, coming from disadvantaged communities, particularly Roma, who had started lower secondary education but, for various reasons, had not finished it. For 3 ½ years they were supported by teachers trained specifically for this job to complete their basic education, and they received job training at an apprenticeship level.

After the Education 2000+ Centre project was completed, the Romanian Ministry of Education started a similar project, "Access to education for disadvantaged groups, with a special focus on Roma," which encouraged schools in communities with a large number of drop-outs to organize Second Chance education. However, the results of the project, which were reported for the first time in the documents of the Final Conference, were less than satisfactory. According to the Final Conference Report, "*statistics from the largest Second Chance programme, in Dambovita* (a.n. – county in Romania)*, indicated that the drop out rate in 2003-2004 was 6.3% as compared to the European average of 6%. But in Arad* (a.n.- county in Romania) *all nine students registered for the programme dropped out.*"

Some of the lessons learnt by implementing the Second Chance programme till 2004 were:

- o the 3 ½ years of daily school attendance were too much for the young people who had already dropped out of school once or several times and who, in some cases, were parents and had to earn their own living;

- the curriculum delivered within the project was only slightly different from the national curriculum for lower secondary education, and the textbooks were those used in regular schools and classrooms, which was both too challenging and not motivating enough for the Second Chance students;
- in order to keep students in school after the experiences they had already had with the formal educational system, a different approach to teaching was crucial.

The above were all important lessons learnt from 1999 to 2004, which served MER when it decided to further develop this program within the framework of the EU-funded Phare 2003 Project, "Access to education for disadvantaged groups." The Phare 2003 version of the lower secondary Second Chance program targeted any person above 14 years who had completed primary education but had not completed secondary education. It provided basic education and vocational training corresponding to grades 5 to 10 in the Romanian compulsory education. Within the project, new methodologies, syllabi and curriculum materials were developed for both primary and lower secondary Second Chance education.

This paper introduces the mathematics curriculum and the curriculum materials developed within the Second Chance program for lower secondary education. Being one of the curriculum authors, I will share some aspects of the curriculum development process and make a brief presentation of the curriculum materials, attempting to highlight their novelty in the context of Romanian mathematics education.

2. Mathematics in the Second Chance program vs. mathematics in the compulsory secondary education

2.1. The curriculum

For the first four years of compulsory secondary education (5th- through 8th-grade), the Romanian National Curriculum model focuses on objectives and on the development of a didactic strategy starting from objectives. In addition to general objectives, it prescribes for each year of study sets of *reference objectives* (skills and sub-skills to be mastered) and **compulsory contents**. Student achievement is measured through a national test at the end of 8th-grade, when students have to demonstrate mastery of the skills and of the content. Through its emphasis on content and skills, the curriculum encourages learning through memorization and practice of algorithms, and leaves hardly any room for differentiated instruction and for real-world connections and applications. It explicitly grants teachers freedom only in deciding the order of the themes mentioned in the chapter entitled *Contents*, and in choosing the most adequate methods for students' meeting the reference objectives and acquiring the compulsory contents.

For the last two years of compulsory education (9th- and 10th-grade), a competence- based curriculum is used, which focuses on learning outcomes. Its main dimension is the operational one (students' ability to operate with concepts), and the link between the curriculum and the expectations of the society can be noticed.

In the table below we are introducing the general aims and the general competencies that should be attained/ developed within the math curriculum (compulsory secondary education):

General aims (5th through the 8th grade)	General competencies (9th and 10th grade)
knowledge and understanding of the concepts, the terminology and the calculation procedures specific to mathematics;	identification of some data and mathematical relations and their correlation varying with the context in which they have been defined;
development of exploration/ investigation	handling quantitative, qualitative, structural,

and problem solving skills;	and contextual data within the terms of a problem;
development of the communication ability by using mathematical language;	using algorithms and mathematical concepts for the local or global description of a concrete situation;
development of the interest and motivation for the study and application of mathematics in various contexts	expressing quantitative or qualitative mathematical characteristics of a concrete situation and of the processing algorithms;
	analyzing and interpreting the mathematical characteristics of a problem;
	producing the mathematic model of various problematic contexts by integrating knowledge from different domains.

When we, the authors, started to work on the Second Chance syllabus, we agreed on the following:

- o The outcomes of the Second Chance mathematics curriculum should be the same as the outcomes of the compulsory curriculum, because the Second Chance certificate is equivalent with the compulsory education certificate;
- o 6 years with 34 school weeks/ school year, with 4 or 5 mathematics hours/week in the compulsory curriculum should become 2 school years with 30 school weeks/year, and maximum 3 mathematics hours/week;
- o The curriculum should have a competence-based design.

We designed the curriculum around four modules, each of the modules based on one competence.

In developing the curriculum, we began by considering the objectives of the math curriculum for the 5th through the 8th grades and the competences for the 9th and the 10th grades, and we formulated four key competences around which we designed four modules. Our guiding principle in designing the curriculum was that, in the Second Chance program, students should be expected to become numerate citizens, competent *through* mathematics and not necessarily *in* mathematics. Without intending to diminish the importance of mathematics as a subject matter, we viewed mathematics in the Second Chance program not as an end in itself but, rather, as a means to developing the key competences.

The table below includes the modules, and the main competence each module develops:

Name of the module	General competence
Numbers	Operating with numbers
Shapes	Determining properties/ dimensions by using measurements in concrete situations
Beyond arithmetic	Working with and displaying data
Mathematical challenges	Using logical-mathematical reasoning in solving problems

Several features of the Second Chance curriculum account for its novelty within Romanian mathematics education:

- o Each key competence is developed mainly within one module. A key competence, once developed, is practiced and demonstrated within the other modules.
- o The abilities of *communicating proficiently in mathematics, working in teams,* and

learning to learn are developed across the 4 modules in contexts created by the teacher. Students work in groups to solve problems, share identified solutions, listen actively to their colleagues' different problem-solving strategies, and discuss the solutions reached.

o The students' world knowledge and experience, as well as their diverse backgrounds are viewed as valuable resources, and the curriculum provides multiple opportunities for integrating them with the new information acquired in the mathematics classroom.

o The time allocated to covering the Second Chance mathematics curriculum is reduced as compared to the compulsory curriculum, but the same outcomes are expected to be attained through: a) employing a constructivist approach to mathematics instruction, with students learning by investigating real-life situations; and b) operating with mathematics concepts from an applied perspective (applying mathematics to solving practical problems).

o The Second Chance curriculum allows for the identification of students' different learning styles and individual learning needs, as well as for differentiated instruction, all of which contribute to raising students' self-esteem and to developing the key competences.

o The evaluation of students' progress is competence-based. At the end of each module, the key competence developed throughout the module is assessed with reference to standards that have been developed to this end.

2.2. Curriculum materials: guidebooks for students and teachers

The authors developed a guidebook for students and a guidebook for teachers for each module. The guidebook for students contains all the lessons of the module, as well as self-evaluation sheets at the end of each chapter and an introduction in the chapter at the beginning of each chapter. Each lesson is built around a constructivist, three-phase (**A**nticipation-**B**uilding knowledge-**C**onsolidation) model. The lessons begin with the **A-**phase, in which students are encouraged to summon up previous knowledge and experiences, and formulate their own questions about the topic they will study. During the second phase of the lesson, the **B**–phase, the teacher leads students in discovering a new concept through inquiry and problem solving carried out in the course of individual, paired, small group, and large group activities. Once students understand the concept(s) in the lesson, they are invited to reflect on what they have learnt and to use the new knowledge in various contexts. This last phase of the lesson is the **C**–phase.

Some activities recommended for the **Anticipation** phase are:

o *debates* on different mathematical quotes (e.g., students are invited to comment on Leopold Kronecker's statement, "God created the integers and all the other numbers are the creation of humankind" and on P. W. Bridgman's, "Nature does not count and integers do not appear in nature. Man created all the numbers, in spite of Kronecker's statement.");

o *predictions* (e.g., students are invited to predict when negative integers were introduced after reading a text about the time when "nothing" was symbolized by "zero");

o group work activities during which students are invited to analyze news items or data from official publications and to figure out what numbers, percentages, graphs communicate (e.g. the *"numbers at news"* activity, during which students are invited to read a piece of news that contains numbers and to discuss the significance of the numerical information);

o pair work to explain *mathematical jokes* (e.g., "A mathematician tells his wife that he will be back home at a quarter of 12. As he gets home at 3, his wife is cross with him for not keeping his promise. The mathematician answers: My dear, I kept my promise… I

told you that I'll be home at a quarter of 12." Students' task is to explain the mathematician's answer, which involves using their knowledge of ratios.);

- *mix-and-match activities* and *"I have…. Who has…?" activities*.

For the **Building-knowledge**-phase, we suggest individual, pair or group work during which learners are led to discover new concepts. Learners investigate by and with the purpose of solving problems. For example, when learning about representing data by bar charts, students, working in small groups, are asked to observe a pie chart (they already learnt to represent data by pie charts) and a bar graph, both representing the same data. Students are asked to analyze both representations, discover how the bar graph was produced, discuss together and find the rule. The teacher finalizes the activity by eliciting the definition of bar graphs and by clarifying the way they are designed. Further, students are asked to read the text: *1000 young people were asked, "What is/ should be the reason for volunteering?" 530 young people answered, "in order to support a cause in which I believe," 170 young people answered, "to use my experience," and 110 young people answered, "to raise my chances of getting a job."* Individually, students are asked to represent the data in the text as a bar graph and then to share their graphs with their peers, and to explain their process of constructing the graph. If there are computers in the school, students will produce the bar chart by using Microsoft Excel.

For the **Consolidation-**phase, students are asked to work in pairs or in small groups in order to apply the discovered rules in real contexts (e.g., 'reading' bar graphs from newspapers). Project work is strongly recommended for this phase of the lesson. Projects are designed to be carried out over a longer period of time. For example, the projects suggested in the *Beyond arithmetic* module should be done step by step: data collection should begin starting with lesson 3, and representing data by using different charts and graphs should follow in lessons 7, 13, 14.
The practice problems and exercises suggested for students are mostly contextual problems that were developed starting from news items, media reports, and real life situations in which young people are commonly involved. This way, learners not only discuss mathematics, but they try to solve real life problems using mathematics.
For example, two texts that students read when studying percentages were the following excerpts from the report *Equal Opportunities for Women and Men- Monitoring Law and Practice in New Member States and Accession Countries of the European Union* of the Open Society Institute on Romania (http://www.cpe.ro):

1) According to statistics, in 2002, $\frac{3}{10}$ of members of the legislative bodies, executive leaders of public administration, leaders and clerks of socio-economic and political units were women.

2) In 2004, women represented $\frac{1}{10}$ of the members of the Parliament.

The students' tasks are to represent the ratios in the text, to compare them with $\frac{51}{100}$, which

represents the ratio of women out of the total Romanian population, and, finally, to discuss about the significance of the comparison.
The guidebooks for teachers were produced to support teachers in delivering the curriculum. They contain suggestions for initial assessment, for adapting the curriculum to the real context, for teaching the content, and for providing differentiated support to individual learners. They also clarify the instructional and assessment approach and the organization of the modules. Each lesson includes instructions and tips for developing each suggested activity.

3. Conclusion

The new Second Chance curriculum started to be implemented in 2005 – 2006 in the Romanian educational system. The student's guidebooks and teacher's guidebooks started to be used in the school year 2006-2007. Currently, a monitoring and evaluation system for the Second Chance program was elaborated and is being implemented. Questions like, *Are the goals and the content sufficiently relevant for Second Chance learners? Is the expected attainment level realistic? Are there enough options to integrateteachers' own ideas? Do the materials give adequate support to teach the curriculum?* are waiting for answers. While waiting for the answers, here is one of the Second Chance students' opinion: *"In a way, it is more difficult to go to school now, because I have other worries too, not only learning – but there are many nice things (compared to the time I went to school): we are spending time talking together, like real people, and the teachers are more patient."*

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