„Be STEM-patic!“

Project focused to the identification, guidance, and teaching of STEM gifted students

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Overview

The „Be STEMpatic!“ project is financed by the European Social Fund and it is focused on the identification, guidance and teaching of STEM gifted students. The project is conducted in the northern part of Croatia, in Virovitica-Podravina county, in 14 elementary schools and 7 high schools.

The presentation will address the main project idea and activities, including a model for the identification of STEM gifted students. The model and later activities of choosing the identification criteria were based on a review of current theoretical models of giftedness and talent and empirical findings about the specific area of STEM giftedness.
Context

The project will last for 16 months and is implemented by the Virovitica-Podravina county in cooperation with 14 elementary schools and 7 high-schools.

A first such project in Croatian educational system.
Aims

1. To develop the model for identification of gifted and talented students in the STEM domain
2. To develop procedure, guidelines and for further identification of STEM gifted and talented and to produce recommendations
3. To strengthen the capacities of educational staff for identification and work with gifted students in STEM domain
Steps that preceded the development of the identification model

- Review of theory-driven and empirically tested models of talent and giftedness
- Review of approaches in conceptually determining talent and giftedness in STEM area and the role of different research traditions: e.g., psychometric, use of nomination, studies of individuals
- Comparative review and selection of the closest models that can be placed in the framework of STEM giftedness
- Review of empirically demonstrated characteristics, competencies, and abilities of individuals who are successful in STEM area
Steps that preceded the development of the identification model

- Review of empirically demonstrated characteristics and behaviors of students who are successful in STEM school and out-of-school area
- Development and operationalization of methods and steps of identifying gifted students in the STEM area, in the school and extracurricular context
- Deciding on psychological constructs that will be implemented within the model of STEM giftedness
- Considering the need to integrate the work of teachers and other expert school staff in the identification of gifted and talented students in the STEM area
- Reviewing the teaching methods of STEM gifted students in school and out-of-school environment that are related to the developed model
The Model - The identification of STEM gifted students

The theoretical basepoint for our model was the Renzulli's three-ring conception of giftedness.
The identification of STEM gifted students

<table>
<thead>
<tr>
<th>Construct</th>
<th>Number of individual instruments/scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>General IQ</td>
<td>3</td>
</tr>
<tr>
<td>Specific cognitive abilities</td>
<td>2</td>
</tr>
<tr>
<td>Tests of knowledge in STEM</td>
<td>4</td>
</tr>
<tr>
<td>Interests and motivation in STEM</td>
<td>16</td>
</tr>
<tr>
<td>STEM creativity</td>
<td>2</td>
</tr>
</tbody>
</table>
Identifying procedure

1. Collecting General Student Data
   Elementary & High schools

- Gathering school data on students’ grades – GPA and grades in individual STEM school subjects
- Collecting information on students’ achievements in STEM competitions and other students’ accomplishments in the STEM area
- Collecting parental consents
Identifying procedure

2. First round of testing & Teacher nominations
   Elementary schools

- Teacher nominations for students with potential giftedness in the STEM area → Teachers in mathematics, technical education, nature, biology, chemistry, and physics
- During 1 school class:
  - A) General Intelligence Test (Raven's Progressive Matrices) - 40 minutes
  - B) Questionnaire that measures interests in the STEM school area - 30 minutes

2. Teacher nominations
   High schools

- Based on the teacher nominations, 20 students from each high school were chose to participate in testing, in total 140 students
Identifying procedure

3. Data entry and cut-off
Elementary schools

• Test results were entered in the database
• Based on IQ scores and teacher nominations we made the first cut-off to select students who will participate in the second round of testing
• Approximately 40% of students were allocated for the second round of testing

3. / High schools
## Identifying procedure

### 4. Second round of testing
**Elementary schools**

- At this stage, the following instruments were applied during the 2 school classes:
  - A) **Objective Test of STEM knowledge** (created within the JOBSTEM project); using the „above-level“ testing - the test only included the tasks with a lower facility index
  - B) **DAT - Spatial relations subtest**
  - C) **DAT – Mechanical reasoning**
  - D) **Creativity measure in STEM area**

### 4. Overall testing
**High schools**

- A) **IQ Test (Raven Advanced)** - 25 minutes
- B) **Spatial relations subtest** - from DAT Battery (30 min)
- C) **DAT – Mechanical reasoning** - from DAT Battery (25 min)
- D) **Questionnaire that measures motivational constructs and interests in the STEM school area**
- E) **Test of STEM knowledge**
- F) **Creativity measure in STEM area**
Identifying procedure

5. Final identification
Elementary & High schools

- After data entry, based on measures of (general) specific abilities, measure of motivational factors, and measures of creativity a decision was made on identified gifted students in the STEM area
Advanced STEM out-of school program for gifted students
Advanced STEM out-of-school program for gifted students

- STEM „camps“ (enrichment program) for gifted primary and high school students were organized

- Camps included workshops on the advanced topics in:
  - **Science** (e.g., „Electricity without dinosaurs“; „Atomic cores, everywhere around us“)
  - **Computing**
  - **Robotics** (e.g., „Assemble and breathe life into your robot“)

- Camps also included vocational guidance workshops
Rezervata biosfere Mura-Drava-Dunav zabilježeno je 318 vrsta.
Program for teacher training in STEM work with gifted students
The structure of workshops

1. Workshop set
   - Identification of STEM talented and gifted students
     - 5 one-day workshops for 21 teachers in the field of math, physics, chemistry, biology, and informatics

2. Workshop set
   - Monitoring the progress of talented and gifted students in the STEM area through the student’s schooling and educational and professional consulting
     - 5 one-day workshops for 21 teachers in the field of math, physics, chemistry, biology, and informatics

3. Workshop set
   - Adopting contemporary methods and forms of educational work in STEM area with STEM talented and gifted students
     - 5 one-day workshops for 21 teachers in the field of math, physics, chemistry, biology, and informatics
Thank you!

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