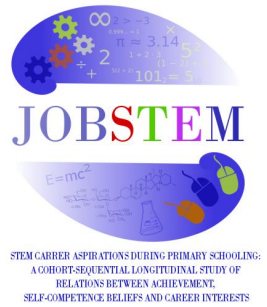
# *The Level of Self-Competence Beliefs Related to STEM School Subjects Achievement among Croatian Primary School Students*

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# JOBSTEM brings together researchers from:

- **Croatia**
  - Institute of Social Sciences Ivo Pilar
  - University of Split, Faculty of Philosophy
  - University of Zagreb, Faculty of Electrical Engineering and Computing
  - University of Zagreb, Faculty of Teacher Education
- **France**
  - Université de Poitiers
- **Hungary**
  - Central European University
- **United States**
  - University of California Irvine

# Research team

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# Three main research goals:

1. To examine how students' general and specific STEM career aspirations are formed and how they change over time.
2. To examine how students' school achievement and self-competence beliefs are related to students' general and specific STEM vocational preferences and how the pattern of these relations changes during primary schooling.
3. To examine how students' general and specific STEM career aspirations are shaped by their families and gender.

# Methodology

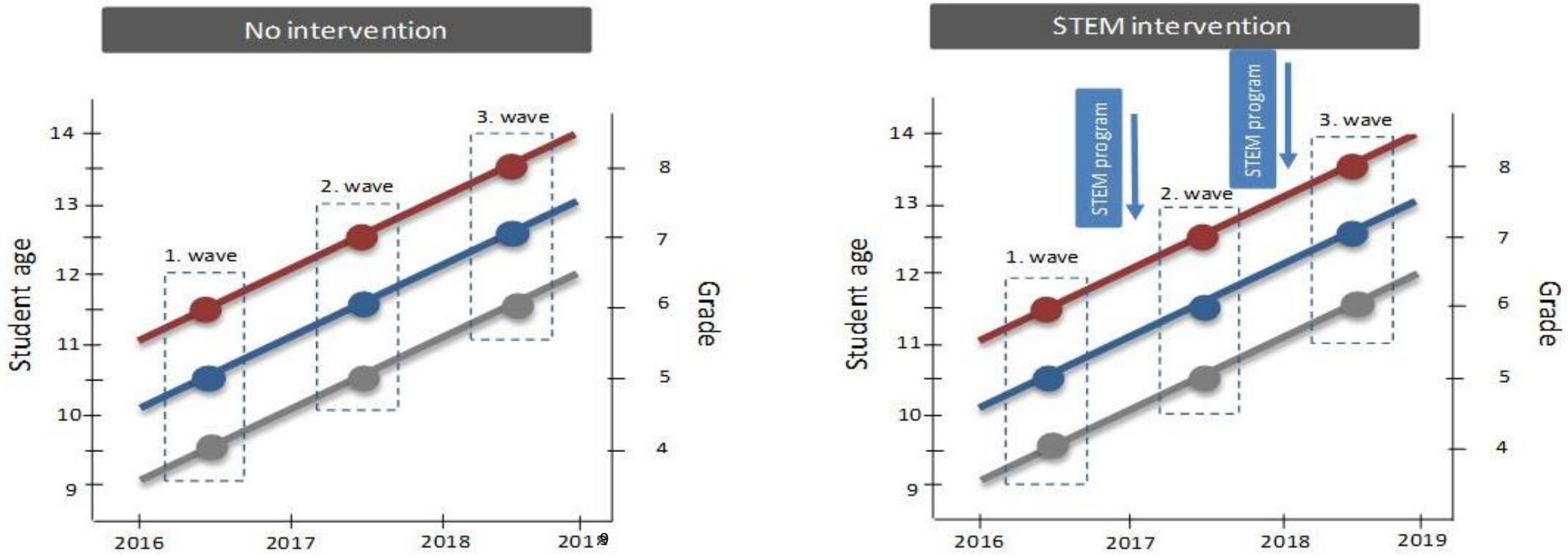
- Longitudinal
- Experimental
- Qualitative

methodological approaches

# Research design

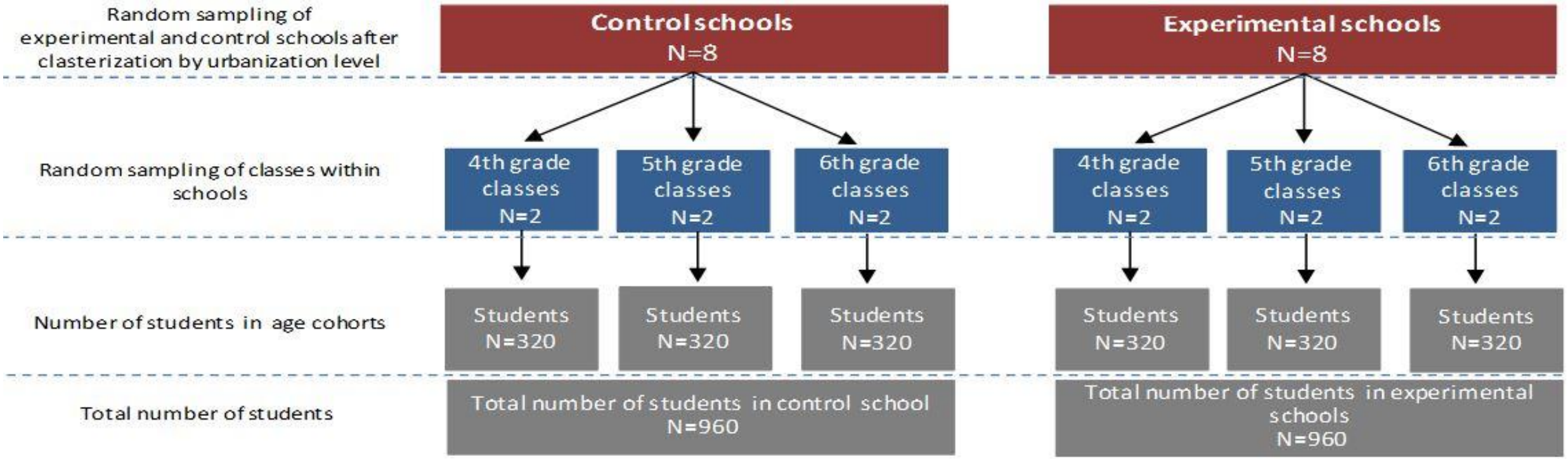
- Longitudinal-sequential (cross-sequential) design that includes three cohorts of primary school students assessed through three successive years.
- Two-group pre and post-test randomized experimental design
- Each STEM intervention in the experimental group is followed by focus group discussions with students

# Figure 1. The longitudinal-sequential design of the study with two-group pre- and post-test randomized experiment



# Participants

- three cohorts of primary school students in three waves during three consecutive years



# Pre-testing (pilot study)

- In 2015. we conducted several pilot-studies
- First pilot study, N=360 primary school students (195 boys and 165 girls), attending grades 6 to 8 (age 12 to 15; M=13.3 years). The second pilot study, N=112 primary school students (51 boys and 61 girls), attending grades 4 to 6 (age 10 to 12; M=10.9 years)
- The main objective of the pilot-studies was to:
  - examine some aspects of feasibility of the JOBSTEM research project;
  - help and empirically provide support in the process of the operationalization of some of the basic research constructs /we tested some constructs from the UK ASPIRES research project (Archer, et al., 2013)/;
  - the help in process of construction of objective measures of school achievement (paper-pencil test of school subjects).

2. To examine how students' school achievement and self-competence beliefs are related to students' general and specific STEM vocational preferences and how the pattern of these relations changes during primary schooling.

# Specific research questions:

- To test different models which explain the structure of academic self-competence beliefs in a STEM school achievement area.
- To examine the relationship of school achievement and self-competence beliefs (ASC and ASE) in the STEM school achievement area, including the structure and causality of their relation and changes through the primary school period.
- To examine to what extent academic self-competence beliefs (ASC and ASE) are related to STEM vocational interests and what is the dynamic of this relation during primary schooling.

2. To examine how students' school achievement and self-competence beliefs are related to students' general and specific STEM vocational preferences and how the pattern of these relations changes during primary schooling.

# Specific research questions:

- To test different models which explain the structure of academic self-competence beliefs in a STEM school achievement area.

  - Hypothesis: *Related self-competence beliefs facets can be recognized within the STEM field as indicators of academic self-concept (ASC) and academic self-efficacy (ASE), which form a clear structure of self-competence beliefs in the STEM school achievement area that is not lost during the period of primary schooling.*

2. To examine how students' school achievement and self-competence beliefs are related to students' general and specific STEM vocational preferences and how the pattern of these relations changes during primary schooling.

# Specific research questions:

- To examine the relationship of school achievement and self-competence beliefs (ASC and ASE) in the STEM school achievement area, including the structure and causality of their relation and changes through the primary school period.

  - Hypothesis: *In the STEM field ASC and ASE are interrelated and the structure of their relation to school achievement remains stable during primary schooling. It is possible to expect differences in the structure of this relation in groups of students with differing levels of interest for the STEM field, most evident in the strength of effect of ASE.*

# Used research constructs

(1) Self-competence beliefs related to science, mathematics and STEM school subjects were assessed with a scale consisting of eight items (e.g. “I am just not good at school science”). The internal consistency of the formed composite was good (Cronbach alpha 0.87). Taking into account the content and valence of each item, two subscales were formed as indicators of

- Positive STEM self-concepts in STEM school subjects.;
- Negative STEM self-concepts in STEM school subjects.;

(2) School experiences with STEM school subjects were operationalized through six items (e.g. “I get good marks in science”). The internal consistency of the composite was good (Cronbach alpha 0.81).;

(3) School achievement in STEM school subjects was measured by school marks. In the Croatian school system and school curriculum the STEM area is covered by the following school subjects, depending on the grade: mathematics, nature and society, biology, chemistry, physics, ICT, technical education and geography.

# Some findings ...(1)

Students in general had a fairly positive STEM self-concept.

They agreed with the opinion that they will be successful in STEM school subjects if they work hard, felt that they are successful in STEM school subjects, that they don't have problems understanding STEM school lessons.

Although the students held positive attitudes, their actual achievement indicated a somewhat different picture. Students are generally less successful in STEM school subjects compared to both their overall GPA, and their marks form non-STEM school subjects.

# Some findings ... (2)

The comparison of school achievement in STEM subjects of students who have a positive STEM self-concept and those who have a negative STEM self-concept yields interesting results.

Croatian primary school students with a positive STEM self-concept are significantly more successful in all the school subjects than students with a negative STEM self-concept (ANOVA results: F= 45.8 for Mathematics; F=28.6 for Biology; F=44.6 for Chemistry; F=11.6 for Physics; F= 12.7 for Computer science; F=31.9 for Technical culture; all calculated test are significant at p=0.05).

Such an outcome is expected and it is in accordance with the findings that students with well-defined self-competence beliefs in a particular school subject or area also have higher success and show better performance in the corresponding subject.

# Some findings ...(3)

Univariate comparison results indicated that girls are more successful than boys in all the STEM school subjects. This is in line with some our recent findings which show that in primary school girls generally outperform boys (Burusic and Seric, 2015).

Multivariate comparisons of boys and girls who hold different STEM self-concepts (positive vs. negative) did not show any statistically significant differences.

Neither the effect of gender nor the effect of STEM self-concept was statistically significant, and there were no statistically significant interaction effects of these factors on the school achievement in STEM school subjects.

# Additional informations:

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# Thank you for your attention!