Theoretical Background

International Preparation Class (IVK)
- Officially established in February 2016 for around 20 migrants from ages 15 to 18.
- Goal: Integration of these pupils in the regular classes (9th or 10th grade) within two years, where they can eventually graduate.
- The very heterogeneous class is usually split into 3-4 different groups (2 teachers).
- The classes are taught in German.

Figurative Numbers as an Approach to Algebraic Expressions
- The weekly timetable consists of:
  - 12hrs German as foreign language,
  - 5-6hrs mathematics,
  - 3hrs English,
  - 2hrs politics,
  - 4-5hrs arts & PE (in regular German classes) and
  - exercise classes in the afternoon.

Figurative Numbers as answers
P1: . . . .
P2: . . . .
P3: . . . .
P4: . . . .
P5: . . . .

Development of the notion of equality
Three steps in this development were observable (more details can be found in [6]):
- Equality is limited to the concrete shape of a figurative number.
- Differently looking algebraic expressions were identified as equal/unequal by numbers plugged in.
- Figurative numbers with linear progression were arranged in a standard form.

Introduction of Variables
Prediger & Krägeloh ([5], p.91) point out that "many German textbooks try to support the construction of the second meaning, the variable as generalizer, by referring to typical linguistic expressions that are used outside algebra classrooms. [...] Assuming these expressions are known by the students, the authors’ intention is to remind students of out-of-school-language resources to help their individual construction of meaning. However, [...] these linguistic resources cannot be taken for granted for all students since they are part of the language of schooling, not necessarily of students’ everyday register."

Figurative Numbers:
A figurative number is a sequence of pictures consisting of dots and the related number sequence (dots: 6, 10, 14, …).

Math-il.de Project
The learning environment Figurative Numbers originated as a subproject from an math-il.de project concerned with algebraic expressions and their manipulation. Math-il.de is an internet platform which was specially designed for developmental research in a group and it supports the communication within the the group. This platform was established in 2009 on the initiative of Rainer Kaenders [2] and its way of proceeding can be sketched as follows:

Goals
- Develop a language-sensitive approach to algebraic expressions via Figurative Numbers:
  - few lingual prerequisites
  - can serve as a catalyst for further development with respect to the language
  - foundation for the justification of manipulation of algebraic expressions
- Broaden the students’ notion of a variable

Outline
Further implementations in international and regular classes are planned.

References