

Report on teacher testing in the Netherlands

Items used:	Item 1 (Definition), item 5 (Graphs), item 6 (Table seating), item 7 (Function machines)
Responsible Partner:	Hogeschool IPABO, Netherlands
Background of the participants (pre- or in-service teachers, particularities):	Pre-service teachers in the second semester of the first year of their primary school teacher education in Amsterdam.
Sample size:	16
Brief Description of Testing (Pre- and / or post-testing) / Intervention (long or short teacher course, covered topics, particularities):	Our teacher course consisted of a one-hour meeting in which the pre-service teachers answered the previously mentioned items and participated in the learning environment of walking on the number line. This happened in parallel groups thus allowing for all teachers to assume the different roles in the learning environment and actively experience the development of their functional thinking within it. The session ended with a whole classroom discussion in which the different effective elements within the learning environment and the teacher educators' interventions were explicated, so that the pre-service teachers were aware of them for later integrating them into their own teaching practice.

Method:

Sixteen pre-service teachers participated in a one-hour meeting in which they answered the previously mentioned items and participated in the learning environment of walking on the number line. This happened in parallel groups thus allowing for all teachers to assume the different roles in the learning environment and actively experience the development of their functional thinking within it. The session ended with a whole classroom discussion in which the different effective elements within the learning environment and the teacher educators' interventions were explicated, so that the pre-service teachers were aware of them for later integrating them into their own teaching practice. The testing was done after the described meeting.

Results and Discussion:

On the different items the pre-service teachers answered variably. On item 1, on the definition of functional thinking, they all replied that it was about mathematics to be functionally applicable in real life.

On item 5 (table seating), eight teachers provided a completely incorrect answer, one a partially correct answer, and seven a correct answer. In their reasoning most participants used correspondence level reasoning (7), one covariational (1), and several recursive/variational (4). The remaining teachers (4) did not provide their reasoning.

On item 6a (moving from-to) only three teachers answered incorrectly, most teachers indicated at least one correct interval, while only three teachers provided the three correct intervals. In their

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reasoning everyone (except the three who provided the incorrect answer) used correspondence reasoning to explain their thoughts.

On item 6b (fastest) seven teachers provided the incorrect answer, seven the partially correct answer, and only two the two correct intervals. In their reasoning about their answers the teachers mostly referred to correspondence general reasoning (10 times) while one teacher used correspondence particular reasoning.

On item 6c (complete the graph) we only looked at the correctness of the different segments of the graph the teachers drew. Eight teachers correctly drew all the segments and their relative inclinations, while seven teachers did not.

On item 7a (function machine: output) and on item 7b (function machine: input) only two teachers provided the correct answer, one a partially correct, and all the others (13) incorrect answers.

On item 7c (function machine: rule) only four teachers provided an answer, two of which used correspondence general reasoning, one repeated the pattern, and the final one did something completely incomprehensible.

All in all it becomes clear that these pre-service teachers struggled with the items on functional thinking, as evidenced by the predominantly incorrect answers they provided. The items on graphical reasoning were more near to their level of reasoning than the items on the function machines. The items on the table seating, were intermediately answered. During their performance in the learning environment of walking the number line interestingly the pre-service teachers exhibited a much higher level of functional thinking. This appears to be much related to the type of reasoning they showed in addition to the (in)correct answer on the items. In their reasoning accompanying the items they did show thoughts related to the correspondence of the input and the output variables, sometimes displayed in a graph, otherwise in numerical values or words. These thoughts were not always (more often not) translated into a correct numerical answer. All in all, we can state that the participating pre-service teachers appear to need (more) learning possibilities to develop their functional thinking as well as their corresponding domain-specific language in order to optimally foster their future students. This could be realized by implementing and reflecting more learning environments as developed in the FunThink project.