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Abstraction Ability as an Indicator of Success for Learning Object-Oriented Programming?

Many computer science educators argue that abstraction is a core competence. For programming education (and CS education in general) it is therefore mandatory to explicitly aim at the development of the students' abstractive skills. But furthermore we anticipate general abstractive skills —abstraction ability— to be an indicator of success for learning programming. Our hypothesis is therefore:

General abstraction ability has a positive impact on programming ability.

Many reports that math is an indicator of success in programming. Our interpretation of this fact is that it is not specific mathematical competencies (e.g. calculus and algebra) that the students need, but rather the more general notion of abstraction ability required to do math that is needed.

To verify our interpretation, we added a research question. Our two research questions are therefore:

1. *Is there a positive correlation between the stage of cognitive development and the students' results in model-based introductory programming?*
2. *Is math an indicator of the cognitive development stage?*

In the article we describe how we have measured abstraction ability: by Adey & Shayer's stage model of cognitive development, a refined model of Inhelder and Piaget's stage theory. There exists validated tests to measure the level of a given student; in our work we used a pendulum test, a test specifically useful for the upper levels.

The programming ability is measured by the exam score for the students' programming course.

Based on a Person correlation we get the rather unexpected result "a very weak correlation". We also calculated the Pearson correlation between the score of the programming exam and the math score from high school. Here we get another unexpected result: there is hardly any correlation between the students' mathematical ability and their cognitive stage.

In a later study (see Bennedsen, J. and Caspersen, M. E. 2008. Abstraction ability as an indicator of success for learning computing science?. In *Proceeding of the Fourth international Workshop on Computing Education Research* (Sydney, Australia, September 06 - 07, 2008). ICER '08. ACM, New York, NY, 15-26. DOI= <http://doi.acm.org/10.1145/1404520.1404523>) we have focused on abstraction ability and computer science in general (not only programming).

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