Parallelism for Lower Grade Students in Computer Science

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Abstract. Parallelism is usually considered as a topic for upper grade students in Computer Science (CS) education. Our paper presents an approach to introduce prallalelism for lower level students aged eleven to 13 broadening their knowledge on real life experiences. Since the language of CS is too complicated for pupils of this age, it is necessary to simplify the terms through didactic reduction and develop understandable terms for younger students. Our concept has been evaluated over the process of two years in different high school classes.

Keywords: parallel processes, lower grade, teaching concepts, didactic reduction

1 Introduction

The idea of teaching parallel processes the "hands-on" way is very popular with primary students. [1] offers a very intuitive example by ordering students by height (first sequentially and then parallel). Similiarly, the advantadge of parallel processing is also presented in the activity "Sorting Networks" in [2].
Our research question was the following:

- Is it possible to teach parallel processes to lower grade students by broadening their consciousness for parallel processes in their everyday life?

2 Course design

In our curriculum we recognized that the used terms are by far too technical and difficult for lower grade students. So we tried to simplify the terms through didactic reduction and filled our category system (see Fig. 1) with examples from the students' everyday life. The terms "time", "influence", "order" and "resource" were developed on the basis of ideas from perceptual psychology and introduced to students. Moreover own examples by students were constructed and filled into the category system to verify the relevance of the terms. The lesson plan included three lessons of 45 minutes length:

		influenced		not influenced	
		same resource	different resource	same resource	different resource
order important	simultaneous	soccer game	interview with a correspondent	sportswear	running against the clock
	not simultaneous	receiving and answering a letter	left voice mail	laundrette	baking a cake
order not important	simultaneous	bread at school	chat	concertgoer	TV
	not simultanuous	preliminairies worldcup	sending emails	emptying the mailbox	different companies

Fig. 1. Category system with examples

Lesson 1: The first lesson was about specifying the terms "time" and "resource" ("location")

Lesson 2: The second lesson was about specifying the terms "order" and "influence"

Lesson 3: The third lesson was about combining the four terms and building our category system and filling it with student examples.

3 Evaluation and Results

Our course was evaluated over the period of two years in different German high school classes in the regular CS classes of the students. In the first year (2015) eight classes participated. In the second year (2016) four classes participated with a slightly modified version of the lesson plan. The lessons were taught by one author himself and two other teachers from his high school with different backgrounds.

The transcription of the lessons led to the result that the terms are suitable with one exception: The term "location" was changed to "resource" due to the unclear definition of the term "location".

References

[1] Gregg, C., et al. (2012): "A Language and Experience Teaching Parallel Programming in Elementary School". In: *Proceedings of SIGCSE12*. New York: ACM. pp. 51-56

[2] Bell, T., Witten, I. and Fellows, M. (2015). *CS Unplugged: An enrichment and extension programme for primary-aged students*. Availabe here: `http://csunplugged.org/wp-content/uploads/2015/03/CSUnplugged_OS_2015_v3.1.pdf`