From Coding to Computational Thinking and Back

Koen DePryck
Vrije Universiteit Brussel
Dept of Educational Sciences
&
Superintendent of education
GO! school district Antwerpen
koen.depryck@vub.ac.be

Abstract
Presentation of Dr. Koen DePryck in the Computational Thinking Session in TEEM 2016 Conference, held in the University of Salamanca (Spain), Nov 2-4, 2016.

Introducing coding in the curriculum at an early age is considered a long-term investment in bridging the skills gap between the technology demands of the labour market and the availability of people to fill them. The keys to success include moving from mere literacy to active control – not only at the level of learners but also at the level of teachers. However, given the fast development of the field, one might wonder whether acquiring specific coding skills really is the essence of introducing coding early in the curriculum. We argue that the reach of ICT –including coding skills-- is much broader than STEM alone and a background in STEM is no longer a requirement for successful coding. The complex link between coding and computational thinking is the real critical success factor. We refer to TACCLE3 (an EU Erasmus+ project) as a successful approach to the implementation and valorisation of computational thinking across the curriculum.

The presented paper may be cited as:

DePryck, K. (2016). From computational thinking to coding and back. In F. J. García-Peñalvo (Ed.), *Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'16) (Salamanca, Spain, November 2-4, 2016)* (pp. 27-29). New York, NY, USA: ACM. doi: 10.1145/3012430.3012492.

This presentation has the following doi: 10.5281/zenodo.205912

Link to the presentation
http://es.slideshare.net/grialusal/from-coding-to-computational-thinking-and-back

Keywords
Computational Thinking; Coding; STEM; TACCLE3

References

[1] Blair, C., 2002. School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist 57*, 2, 111-127. DOI=http://dx.doi.org/http://dx.doi.org/10.1037/0003-066X.57.2.111.

[2] Blakey, E. and Spence, S., 1990. *Developing Metacognition.* ERIC.

[3] Brennan, K. and Resnick, M., 2012. New frameworks for studying and assessing the development of computational thinking. In *Proceedings of the Annual American Educational Research Association meeting* (Vancouver, BC, Canada2012).

[4] Bryce, D., Whitebread, D., and Szucs, D., 2015. The relationships among executive functions, metacognitive skills and educational achievement in 5 and 7 year-old children. *Metacognition & Learning 10*, 2, 181-198.

[5] Buck, D. and Stucki, D.J., 2001. JKarelRobot: a case study in supporting levels of cognitive development in the computer science curriculum. *SIGCSE Bull. 33*, 1, 16-20. DOI= http://dx.doi.org/10.1145/366413.364529.

[6] Chetty, J. and Van Der Westhuizen, D., 2014. Implementing Metacognition Skills for Learners Studying Computer Programming. In *Proceedings of EdMedia: World Conference on Educational Media and Technology 2014. Jun 23, 2014, Tampere, Finland*, J. Viteli and M. Leikomaa Eds. Association for the Advancement of Computing in Education (AACE), Waynesville, NC, USA, 726-731.

[7] Cuny, J., Snyder, L., and Wing, J.M., 2010. Demystifying computational thinking for noncomputer scientists.

[8] Depryck, K., 2016. From computational thinking to coding and back. In *Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'16) (Salamanca, Spain, November 2-4, 2016)*, F.J. García-Peñalvo Ed. ACM, New York, NY, USA, 27-29. DOI= http://dx.doi.org/10.1145/3012430.3012492.

[9] Fessakis, G., Gouli, E., and Mavroudi, E., 2013. Problem solving by 5–6 years old kindergarten children in a computer programming environment: A case study. *Computers & Education 63*(4//), 87-97. DOI= http://dx.doi.org/http://dx.doi.org/10.1016/j.compedu.2012.11.016.

[10] García-Peñalvo, F.J., 2016. A brief introduction to TACCLE 3 – Coding European Project. In *2016 International Symposium on Computers in Education (SIIE)*, F.J. García-Peñalvo and J.A. Mendes Eds. IEEE, USA.

[11] García-Peñalvo, F.J., 2016. Presentation of the TACCLE3 Coding European Project. http://repositorio.grial.eu/handle/grial/654.

[12] García-Peñalvo, F.J., 2016. Proyecto TACCLE3 – Coding. In *XVIII Simposio Internacional de Informática Educativa, SIIE 2016*, F.J. García-Peñalvo and J.A. Mendes Eds. Ediciones Universidad de Salamanca, Salamanca, España, 187-189.

[13] Gottfried, A.E., 1990. Academic intrinsic motivation in young elementary school children. *Journal of Educational Psychology 82*, 525-538.

[14] Hwang, W.-Y., Wang, C., Hwang, G.-J., Huang, Y.-M., and Huang, S., 2008. A web-based programming learning environment to support cognitive development. *Interacting with Computers 20*, 524-534. DOI= http://dx.doi.org/http://dx.doi.org/10.1016/j.intcom.2008.07.002.

[15] Israel, M., Pearson, J.N., Tapia, T., Wherfel, Q.M., and Reese, G., 2015. Supporting all learners in school-wide computational thinking: A cross-case qualitative analysis. *Computers & Education 82*(Mar), 263-279. DOI= http://dx.doi.org/10.1016/j.compedu.2014.11.022.

[16] Lyon, G.R. and Krasnegor, N.A., 1996. *Attention, memory, and executive function*. Paul H Brookes Publishing Company, Baltimore, USA.

[17] Pea, R. and Kurland, D., 1984. On the cognitive effects of learning computer programming. *New Ideas in Psychology 2*, 137–168.

[18] Skinner, E.A., Zimmer-Gembeck, M.J., Connell, J.P., Eccles, J.S., and Wellborn, J.G., 1998. Individual Differences and the Development of Perceived Control. *Monographs of the Society for Research in Child Development 63*, 2/3, i+iii+v-vi+1-231.

[19] Tacle 3 Consortium, 2016. TACCLE 3: Coding Erasmus + Project website. http://www.tacle3.eu/.

[20] Zelazo, P.D., Carter, A., Reznick, J.S., and Frye, D., 1997. Early development of executive function: A problem-solving framework. *Review of General Psychology 1*, 198-226.