



Education XXI

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The issue of education in the 21st century [1] is related to the Polish plans for development [2] and upcoming presidency of EU. In this context, a conference called STHESCA is being organized in July 2011 [3]. As a part of preparations to the conference, a seminar was held [4] that served the purpose of defining a concrete starting point for discussions on the subjects of science, technology, and higher education in contemporary society. Debate during the seminar, in the form of open questions and answers, was led by Kenneth G. Wilson, Nobel laureate in physics. The proposed starting point for discussions at STHESCA obtained the working title “**e and E**”. Lower-case, or **small e** denotes the contemporary worldwide system of education rooted in the design formulated by Johann Amos Comenius in the 17th century [5]. Upper-case, or **big E** denotes a system on a par with contemporary needs.



FIG. 1: Kenneth G. Wilson during a discussion with students; a meeting of Physics Club, 15 XI 2010, Aula of Faculty of Physics in University of Warsaw; skfiz.fuw.edu.pl

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Table I gives examples of features of **e** that, in comparison with features of **E**, seem outdated. These examples illustrate that improvement of **e** does not automatically lead to creation of **E**. The issue for discussion on education in 21st century during STHESCA is addressed below after an explanation of the examples in Table I.

TABLE I: Examples illustrating differences between systems **e** and **E** [19].

nr	e	E
1	subject matter	person
2	curriculum	context
3	focus on student weaknesses	focus on student strengths
4	separation of values from subject	natural connection of subject with values
5	one-size-fits-all testing for grades	individualized informative assessment
6	passing exams	performance
7	Comenian system	post-Comenian system
8	lack of accountability for learning	accountability for learning à la RR
9	teaching according to age	individualized teaching, life-long
10	no self-correction system	systematic self-correction system
11	compulsion	one's will
12	–	life-long brain development
13	–	ten thousand hours

Explanations for Table I:

1. System **e** is focused on teaching subject matter, whereas **E** is focused on educating a person in the context of a subject.
 2. In **e**, the dominant form of teaching is specified by a curriculum independently of the context of students' lives. In **E**, a context important to students is a natural stimulus for

learning important concepts.

3. In **e**, students are punished if they do not know, do not understand, or cannot do something, until they fulfill the requirements, even if only superficially. In **E**, students improve upon what they are good at, and this is how they notice new elements and directions worth studying.



FIG. 2: From left: Kenneth G. Wilson, Maciej A. Nowak, Tadeusz Marek, and President of Jagiellonian University - Karol Musioł
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4. In **e**, teaching subject matter is disconnected from teaching values and building character. Natural sharing of useful information about the world among people in a group in **E** replaces destructive competition [6] and teaches principles of understanding in making decisions and handling resources.
5. One-size-fits-all testing for grades in **e** is replaced in **E** by providing feedback regarding individual progress in skill acquisition.
6. Testing of short-term memorizing “to get credit” in **e** is replaced in **E** by assessment of student performance in practice, akin to how skills of all other members of the system **E** are assessed [7, 8].
7. Comenius designed the process of teaching students in **e** as analogous to printing books in a press, while **E** fulfills

contemporary requirements [9].

8. *Reading Recovery* (RR) [10] has a system for monitoring teachers’ work in terms of their students’ progress in acquiring skills. This is worth studying as a candidate for use in **E**; there is no such system in **e** [11].
9. **e** functions like a production line ordered according to age, while **E** accounts for differences among students, enabling them to develop over the lifespan [9].
10. **e** becomes outdated and fails, having no system of self-correction, while **E** is by definition being created so that it changes in agreement with the needs of its clients [12, 13].
11. **e** is based on compulsion, and **E** on students’ will to learn [14], in agreement with the hypothesis [15] that processes of learning based on will are those that lead to true learning, associated with changes in structure and functioning of the brain and other body parts.
12. In **e**, the human brain is treated in practice as a device ready for one-time programming, while in **E** as an organ that grows and changes throughout the lifespan [16].
13. Ten thousand hours is the amount of time of deliberate practice required for reaching an expert level of performance [17, 18], and a teacher needs this much deliberate practice to become a good teacher in **E**.

Explanation of number 7 in Table I says that a sketch of specifications for system **E**, congruent with the direction of development of the contemporary world, has already been drawn by Drucker [9], who during his nearly century-long life actively studied *the practice* of management processes involved in the transition of the most-developed countries from domination of manual work according to instruction to domination of mental work based on knowledge and skills. Specifications for the emerging system **E** and already predictable mechanisms of creating, principles of measuring (different from the ones applied in **e**), and methods of improving **E** by new generations until **e** is almost completely eliminated, probably still in the 21st century, may be the starting point for discussion during STHESCA.

Suppose that inhabitants of the most-advanced countries cease to accept systems of type **e** and learn in them less and less effectively, while the systems of type **e** enriched with new knowledge and technology continue to be very effective in developing countries. A question arises: *Is not a change from e to E in the leading countries a necessary condition for their continued fulfillment of this role?*

[1] www.oecd.org/dataoecd/34/60/46619703.pdf.
 [2] <http://www.polska2030.pl>.
 [3] *Science, Technology, Higher Education and Society in Conceptual Age*, Cracow, July 5-7, 2011; www.sthesca.eu.
 [4] *Koncepcje edukacji w XXI wieku*, UJ-PAU, 16-17 XI '10.
 [5] J. A. Comenius, *Didactica Magna* (Amsterdam, 1657).
 [6] D. Bok, *President's Report '86-'87*, Harvard University.
 [7] P. Drucker, J. Maciariello, *Management* (Harper, '08).
 [8] <http://www.cgu.edu/pages/281.asp>
 [9] P. Drucker, *Post-Capitalist Society* (Harper, 1993); 197.
 [10] www.readingrecovery.org.

[11] K. Wilson, private discussion.
 [12] K. Wilson, B. Daviss, *Redesigning Education* (Holt, '94).
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 [15] Bibliography in S. Głazek, arxiv.org/abs/0804.4796.
 [16] Np. R. D. Fields, *Science* **330**, 768 (2010).
 [17] K. A. Ericsson, *Acad. Medicine* **79**, S70 (2004).
 [18] M. Gladwell, *Outliers* (Penguin, 2008).
 [19] C. Barsky, S. Głazek, K. Wilson, *e and E*, in [4].