

Student-centered school, competency development and playful, experiential mathematics learning in Hungary

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Abstract

As colleagues of the Faculty of Culture, Education and Regional Development at the University of Pécs (Hungary), we have been striving for decades to ensure that teachers contribute as successfully as possible to the development of the most important competencies of their students. In our thesis we highlighted three topics (each related to a renowned psychologist) we found important in our teacher training practice. Based on the work of *Carl Rogers*, the person-centered approach has influenced the mindset of helping professionals worldwide over the past sixty years. In the 80's we started spreading it from the Juhász Gyula Teacher Training College in Szeged, and then from the University of Pécs. *John Raven's* psychocybernetic approach points out that education is a complex system in which positive changes in one factor can be detrimental to overall performance due to complex interactions. When the University of Pécs awarded John Raven an honorary doctorate, it also wanted to show that we want to build more on his work in teacher education. *Zoltán Pál Dienes* is considered the most exciting figure in playful, experiential, exploratory mathematics learning/teaching worldwide. In the last years of his life, he also became an honorary doctor of the University of Pécs and we undertook to bring his mathematical games (learning aids) to Hungarian schools. We hope that the "Dienes method" will make everyone like this anxiety-inducing subject, which is still foreign to many students today. The trends presented in this paper can help make our educational practice more child-centered and effective if we continue to make serious efforts.

Keywords: person-centered approach; psychocybernetics; playful learning

Introduction

Forty years ago, in response to a journalist's question, Sándor Klein replied:

"... Our schools should primarily aim to help children develop healthy personality. Of course, a person with a well developed personality has a fairly good knowledge base, which he/she can activate and use if necessary. Personal development can best take place through voluntary learning with interest and full attention... A school from which mentally crippled, anxious or aggressive, narrowly interested, incapable of human contact, selfless and unappreciative, irresponsible people emerge, does not fulfill its function, no matter how many multiplications children can do in 5 minutes, no matter how much historical data they store in their heads."

In this article, we focus on the positives: some efforts that can move organised learning in a more humanistic direction.

Carl Rogers and the Student-Centered School

Carl Rogers (1902–1987) became world-famous primarily as the creator of client-centered psychotherapy. Over time, however, he realized that the attitudinal conditions that allow the "healing" of those with mental health problems contribute to success in all other helping professions: they can make the activities of teachers, leaders and parents more effective. This is how the *person-centered approach* that is now characteristic of many types of helping relationships was created. From the perspective of a *student-centred school*, this means that teachers appear to be authentic, accepting and emphatic understanding in the eyes of students (Klein, 2016). In Hungary, this approach was radically novel in the 80s.

"In schools, the curriculum is more central than the children. The teacher plays a central role: he knows all secrets, he asks, he decides whether the answer is correct, he evaluates – as if everything was turned upside down. But that's always been the case! And then Carl Rogers comes along and writes: School can become a place for exciting and meaningful learning. It can be a place where teacher and student learn from each other. We just have to take the risk of taking off the teacher's mask and being ourselves." (Klein, 2013, p. 142):

In a paper (originally published in 1957), Carl Rogers wrote the following:

"My experience has been that I cannot teach another person how to teach.", "... anything that can be taught to another is relatively inconsequential, and has little or no significant influence on human behavior.", "... the only learning which significantly influences human behavior is self-discovered, self-appropriated learning" Rogers (2003)

In his book "Freedom to Learn" (Rogers & Freiberg, 2013) he has many more messages:

- schools should become an interesting place (unfortunately boring for many, many children today),
- *"the essence of learning is the extraordinary interest in the issues that are significant to me"*
- the whole person – emotions and thinking together – participate in essential learning,
- teaching is even harder than learning, since with the help of a true teacher, we learn how to learn,
- *if we want to be facilitators of others' learning, we must be facilitators of our own learning* (open to receiving what young people have to say)
- responsible freedom in the classroom can only come about through a gradual process of development, the joint efforts of teacher and student.

In the same book, Rogers emphasizes that an honest, accepting, understanding teacher behaves so differently in the classroom than the "traditional teacher" that it is worth calling him the "facilitator of learning." The facilitator creates an atmosphere in which the student is free to make mistakes and thus learn from his peers, the teacher and his experiences without anxiety: he revives the enthusiastic joy of learning that so characterizes early childhood.

The person-centred approach influenced the thinking of teachers, psychologists and doctors here and there in Hungary in the 70s – for example, Béla Buda's book on *„the Art of Empathy“*, published in 1978, was a significant achievement at this time – , but the real breakthrough was the international cross-cultural meetings organized by the Juhász Gyula Teacher Training College and the Hungarian Psychological Association in Szeged in 1984 and 1986, at which some 300 people, with the help of Carl Rogers and his colleagues, experienced the difficulties and potential of responsible freedom.

Since 2009, these week-long meetings have been organized annually again with the help of the University of Pécs (primarily the Faculty of Cultural Sciences, Education and Regional Development), increasingly as part of a living person-centered movement. After the meetings in Szeged, some „Rogerian“ schools were established in Hungary (Rogers Person-Centered School, Blue Bird Person-Centered Pedagogical Program, Colorful School in Tata), the Hungarian Association of Person-Centered Psychotherapy and Counselling was founded, important books related to the person-centered approach have been published,

individual client-centered therapy, encounter groups have become available – the past four decades can be considered a success story from this point of view.

Cross-cultural Communication meetings are especially suitable for developing the communication skills of teachers and practicing their "congruence, acceptance, and empathy". We would like as many teachers as possible to take advantage of this opportunity not only in Hungary, but also from other countries.

We consider it an important task to continue to help spread the person-centered approach and make schools student-centered.

John Raven and developing competencies

Ten years ago, the Faculty of Adult Education and Human Resource Development of the University of Pécs awarded John Raven an honorary doctorate. John Raven is perhaps the most original figure in the competence movement. In his writings, he proves with data from extensive surveys that educational practice that stuffs knowledge into students' heads does not promote excellent performance at work. Specific knowledge is relatively easy to acquire, but quickly becomes obsolete and contributes little to the significant difference in performance between competent and incompetent workers. The focus should be on developing competencies such as the ability to understand and effectively develop the organization in which we work and live (Raven, 2001). To do this, we would need to transform our schools into 'development environments' (Raven, 2020). Schools should become places in which

- teachers and pupils can resolve conflicts in an open, supportive atmosphere,
- "different behavior", making mistakes does not ridicule and does not lead to serious, long-term negative consequences,
- students are encouraged to set difficult (but realistic) goals and are helped if for some reason they are unable to meet their own expectations.

Clarification of values and behavior in accordance with those values are essential for the development of competencies (Raven, 1977).

Research has shown (Raven, 1984, pp. 132-149) that the most important characteristic distinguishing between more efficient and less effective leaders is how much time they devote to developing their subordinates. Similarly: the parents of creative, high-achieving adults mostly encouraged them to be independent from early childhood, trusted that they were able to make decisions

about issues affecting them, expected them to perform their tasks themselves with serious effort and minimal help, and did not impose their ethical views on them.

Raven emphasizes the importance of project-based, exploratory learning in school. Among its positive examples there are many that have led to serious social action (for example, the pollution study of a local river). These projects not only introduced children to social research, but also developed their competencies for initiating effective social actions (Raven, 1984, pp. 138-139).

We agree with him that schools can only be successful in developing students' competencies if they pay attention to individual differences: "different students need to develop different competencies and different methods must be used for different children to develop a certain competency" (Raven, 1991, p. 81).

Like Rogers, Raven believes it is crucial to change the role of the teacher: from a lecturer to a facilitator of development, from a center of attention to a source of wisdom. Instead of "teaching competencies", teachers should have "leadership competencies", among which the ability to influence the immediate and wider environment plays an important role (Raven, 1990).

John Raven's ideas (such as the importance of social responsibility of teachers) should become an important part of our teacher training practice.

Zoltán Dienes and playful, experiential mathematics learning

Carl Rogers and John Raven sought to transform the entire school learning to meet the demands of a rapidly changing world, while Zoltán Dienes selected a very important subject and sought to reform it worldwide (Dienes, 2014).

He thought that the situation described by György Pólya in his book *How to solve it* is quite realistic: "... future teachers pass through the elementary schools learning to detest mathematics... They return to the elementary school to teach a new generations to detest it." (Pólya, 1957).

He saw the goal of learning mathematics in the development of thinking and especially mathematical thinking (Dienes, 1967). The mathematics learning environment outlined by him also stimulates students' personality development and social behavior.

This requires drastically reforming not only the subject, but also the teaching/learning methodology (e.g., he did not question the occasional use of frontal teaching or individual learning, but placed special emphasis on cooperative small group sessions).

Dienes' *theory of learning mathematics* is based on four principles:

1. the *Principle of Constructivity* (according to Dienes, mathematical concepts must be recreated over and over again; during the game the child "sees", discovers the structure inherent in the tools, "reads" the rules from them),
2. the *Principle of Mathematical Variability* (mathematical concepts can only be abstracted from several models),
3. the *Principle of Dynamic* (it is necessary to create the possibility of transformations within models, "flipping" one model into another),
4. the *Principle of Perceptual Variability* (the same structure is worth dressing up in many ways).

Dienes found that there are different *stages of mathematics learning*:

1. *free play* (this is when the child first encounters several concrete components from which he later constructs the concept),
2. *rule-game* (at this stage, you can give children games tied with certain rules, but also make sure that the rules are not considered sacrosanct),
3. *recognition of common structure* (you need a lot of games that have a common structure),
4. *representation of the common structure* (representation helps to recognize what is common in games that "embody" structure),
5. *description of the structure depicted* (symbolization is the stage of introduction of mathematical notation),
6. *formalization* (the path from axioms to theorems).

The "Dienes method" is theoretically well-established, but its true beauty can only be revealed to those who pay attention to their practice, especially the many games he constructed. The essence of this method is a "mathematical environment" in which the main source of learning is the children's own experience. This is in stark contrast to the traditional method of teaching mathematics: "taking a symbolic funnel through which you mix the knowledge and pour it into the brain of a child and then you test him and see if he gives the *right response*" said Zoltán Dienes in a conversation with Sándor Klein (Klein, 1987, p. 60). Dienes in every way supported the inclusion of the natural environment in the process of mathematical abstraction, but believed that the development of purposefully shaped playful teaching tools was necessary for the development of abstract thinking, which is the essence of mathematics. Perhaps his most influential innovation to date is the variety of playful teaching tools based on

mathematical structures that can be used to facilitate the development of abstract concepts.

"Playing is a wonderful thing. It makes us active and makes us forget that we are tired. It can evoke in the child an effort worthy of an adult, and in the adult it can awaken the dormant, oppressed child. While playing, we can learn almost imperceptibly and joyfully things that otherwise would have been very difficult for us to comprehend, from which, if we knew how serious they were, we would have narrowly closed our ears and minds before we had a chance to understand the essence of the problem." (Klein et al., 2021, p. 199)

An early book by Dienes (Holt & Dienes, 1973) explored the possibilities of mathematical games for children aged 4 to 5, while two later volumes (Dienes, 2003; Thomas, 2009) provides plenty materials to think about for "mature youth" and young people forever in spirit. Throughout his life, Dienes scattered his ideas about mathematical games around the world with "rich carelessness", many of which found their way into school practice in some countries about half a century ago, but today hardly anything of them can be found here and there.

The revival of the "Dienes method"

Zoltán P. Dienes died in Canada on January 11, 2014 at the age of 97, and Julianna Kiss and Sándor Klein represented his students at his funeral. Eight months later, two old-fashioned suitcases arrived in Pécs (Hungary): part of Zoltán Dienes' legacy, books, studies, documents, photographs and, of course, original toys. The battered objects recovered from travel suitcases, which must have travelled around the world several times, had a great influence on the authors of this paper, and from the fragments a man who was ready to teach, educate and do something for his fellow human beings emerged. Professor Dienes believed in the power of playful, experiential learning and that universal languages of mathematics and logic, regardless of age, geography or culture, can often be necessary for effective communication.

The Faculty of Adult Education and Human Resource Development of the University of Pécs, and later the Faculty of Cultural Sciences, Education and Regional Development in Szekszárd proudly undertook the management of the intellectual heritage of the renowned professor.



Figure 1. *The arrival of the Dienes heritage at the University of Pécs.* Source: authors' own recording

At the Faculty of Cultural Sciences, and Regional Development, the Zoltán Dienes Teacher Training and Children's Culture Methodology Research Centre named after the professor was established in 2018. The most important task of the centre is to care for the Dienes heritage, and in this spirit to coordinate interdisciplinary professional programs that contribute to the renewal of pedagogical practices and the establishment of national and international cooperation between professionals dealing with the topic of children's culture.

The colleagues of the research centre and the faculty have done a lot recently to ensure that after the end of this productive and truly special life, the work of Zoltán Dienes can be shown again to the interested Hungarian audience and a worthy memorial to the world-famous professor in the digital world of the 21st century, one of the most important milestones of which is the *Dienes Virtual Museum*, unique in Hungary, completed in the summer of 2020 (Internet access: <http://dienesmuzeum.kpvk.pte.hu/>). Hungary's first virtual museum, visitors from anywhere in the world can get an insight into the work of the world-famous scientist and his achievements in playful mathematics teaching.

There are many virtual museums around the world, but these initiatives are usually photographed and digitised versions of existing museums. The Dienes Virtual Museum is special in that it does not exist anywhere in reality: but in the virtual space.

Visitors arriving at the central hall of the virtual museum can get acquainted with the life and work of Zoltán Dienes in three rooms. In *the first room* they can find the most important stages of the professor's life. The second room, called "Globetrotting Scientist", guides you to places, educational and cultural centers and institutions located in different parts of the world, where Zoltán Dienes lived with his family in the later stages of his life and taught for longer or shorter periods. The *third room*, "The heritage – the footprint of the scientist (the afterlife of the method)" focuses on the most important messages of Dienes' oeuvre, presenting the essence of experiential mathematics teaching. The museum is enriched with rich imagery. An excerpt from Zoltán Dienes' autobiographical book can be heard in a lecture by Sándor Klein.

In the future, the museum will be connected to the organization of further training and events directly serving Dienes' oeuvre, experiential mathematics education, and the introduction and popularization of experiential pedagogical methods. The English version of the Dienes Virtual Museum will be prepared, the museum shop will be replenished with books, publications and games.

In recent years we have made serious efforts to revive the "Dienes games" from their Sleeping Beauty dream: we have redesigned Dienes' game and strive to spread them domestically and internationally. These manipulatives, dusted off and in a new guise, can serve as a link between the school board and the computer. Dienes realized that if he combined the inner stimulus (source of pleasure) inherent in play with the many embodiments of mathematical concepts and structures, children would be able to recognize much more complex relationships than previously imagined.

We strive to gradually establish "Dienes math labs" in schools, which can develop into centers for the development of creative thinking. We believe that the Dienes educational toys (*Who goes to the castle?* and *Forest Game*) produced so far and distributed to many Hungarian and cross-border schools with the support of several organizations (including the Hungarian Energy and Public Utility Regulatory Authority, the Klebelsberg Center, Piatnik Budapest Kft. and the University of Pécs) are a good start with the two new ones (*Pearls* and *AbrakaDabra*) that have recently been prepared for production, others will follow shortly.



Figure 2. Finished Dienes toys. Source: Piatnik Budapest Kft.

The *Who goes to the castle?* for example, is based on simple logical operations (*and, or, if and only if, negation*), but children who play with it do not need to know this: their task is to get exactly the designated ones out of eight wanderers to the castle (or forest), building a "good road" (in the "most economical way") by properly selecting the necessary road details and signposts (Klein et al., 2021a). The advantage of the game is that both very simple and very complex tasks can be formulated in the given structure, so they can be played by both preschoolers and university students. Another advantage is that it can be played as an individual or group activity, as well as competitively, so cooperation and competition can be practiced with it.

In the *Forest Game* there are 13 prisms and 13 property cards. Trees are painted on the prisms according to certain regularities: 0, 1 or 2 pines, oaks or willow on both visible sides (if there is one pine on one side, then two on the other, if there is no pine on one side, then there is no pine on the other side, etc.). The number of trees can be added together, but in this game you have to subtract three or multiples of numbers larger than two – for example, $2+2=1$, $2+2+2=0$. Each prism has four properties, and each property is characteristic of exactly four prisms. Both prisms and property cards can be turned into 3×3 "magic squares".

Here, of course, we could only illustrate how rich the mathematical background of these games is.

Incorporating Dienes games into today's school practice is not an easy task. Recently we started training primary school teachers on how to do this. We

honestly hope, that with the help of the Dienes method, learning math could be fun.

Conclusion

Our rapidly changing world poses ever greater challenges to our young people, who can only meet them with a school system that prepares them for these changes. We have highlighted three aspirations that can help schools in this momentous task. In addition to scientific thoroughness, it takes commitment, courage and perseverance to follow the path shown by Rogers, Raven and Dienes. Despite the undoubted successes of recent decades, we are only at the beginning of the journey today.

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