The theory of crystallizing experiences and some of its applications in supporting the development of mathematically gifted people

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There are wonderful moments in our lives that we would like to remember for as long as possible, and those that we do not like to get back to. There are those that make us aware of something important and those that potentially do not matter much. Scientific research shows us that these somehow important events are significant for the development of mathematical aptitude. Both the experiences that crystallize giftedness and the experiences that paralyze them, play a huge role in the entire course of human life. What to do to identify them best and use their full potential? I will try to answer this question in the text below.

Keywords: crystallizing experiences; mathematical aptitude; human potential; the course of human life.

Where did the idea come from and about Charlotte Buhler's *The Course of Human Life*

Before discussing the theory of crystallizing experiences, I am going to give you some information about my previous research experiences gathered in the course of analyzing the life and scientific careers of prominent mathematicians.

Over the last five years, I have completed a research project (2014-2018; 2019-2020) in which I distinguish two stages. The first is related to my doctoral dissertation, entitled *Milestones in the life course of distinguished mathematicians and mathematically gifted adolescents.* In the course of this research, I was able to identify different categories of milestones responsible for directing the mind towards the mathematics of the test subjects. My research group included 24 people. They were divided into four distinct ones: the deceased, distinguished professors of mathematics, modern professors of mathematics, outstanding doctoral students and doctors of mathematics faculties, and winners of the International Mathematics Olympiad (IMO). After completing the research program related to the doctoral dissertation, I noticed that it is worth extending the information on the laureates of international mathematics competitions, because they have an educational path ahead of them, which can still be influenced.

The second one was financed by the National Science Center in Poland: type of grant: Miniatura 3 and titled: *Crystallizing experiences in developing mathematical abilities of Polish laureates of International Mathematical Olympiad (IMO).* The research group included 14 winners of the International Mathematics Olympiad.

While analyzing the fate of life, I applied Buhler's method presented in the monograph entitled *"The course of human life"* (1933). This method is connected with crystallizing experiences and therefore describes it. The author considers the life fate of selected people against the background of environmental influences, taking into account the events that had an impact on the course.

Human life is divided into stages of experiences and achievements. The individual phases of achievement overlap with the phases of experience. The first phase of accomplishment falls on the second phase of experience. (Bühler 1999, p.110) describes two types of experience phases:

• phases of experiences related to biological human functioning;

• interprets the phases of experiences from the point of view of human destiny.

The destiny of Bühler (1999, p.111) understands this as the realisation of "being for something", the fulfillment of a life goal.

According to Bühler (1999, p.111) life is given in order to find its unique meaning, which is expressed in the conscious destiny of it "to be fulfilled" - for other people (someone) or for an idea (something). If a discovery appears in a person's life that only they can decide about the destiny of their life (and that this destiny results from the values they recognize), then he finds the meaning of life. Only such a person who is capable of living life in accordance with the principles of his art (principles of the art of living) realizes destiny - meaning. At the same time, they are able to transform them into life goals – by consistently implementing them.

Some people knew from an early age what they wanted to devote their lives to, what makes them happy and fulfills them. However, this was not necessarily the case; it happened that a meeting with a person, who infected even mature individuals with their passion, influenced the choice of the path in life.

Such events, which I call ‘milestones’, have occurred quite often in the lives of mathematically gifted people. According to the research conducted in connection with my doctoral dissertation (2018) and further research (2019, 2020), in the lives of outstanding mathematicians, there were people, events or things that, from their later perspective, were related to the shaping of their minds towards mathematics.

With all this in mind, while knowing the theory of Feldman (1980) further developed by Gardner and Walters (1984), I decided that the experiences of the mathematicians I studied can be considered as crystallizing experiences. Such a method allows to determine the experiences that have an impact on the development of mathematical talents and the shaping of the scientific careers of mathematicians.

A date with your own destiny

While studying the state of knowledge in this area, I noticed that there are many terms indicating important moments in human life that affect the development of mental predispositions and life fate. A very interesting synthesis of these concepts was presented by Wrona (2015). The author systematized the theory in which she described the nature of the experience, the way it influences and the result: Border situation, Critical events, The critical phase, The critical period, Crisis situation, Crisis, Social life breakthrough, A breakthrough point, Nuclear Episode, Peak Experience, The gout experience, Crystalizing experience, A Turning Point, Changing Event.

Transitions, changes and breakthroughs are part of human life, setting the path of its development and creating a unified whole. All these "special" events area signpost towards fulfillment and finding the true meaning of life.

My research experience shows that the experiences related to the relationship have significant importance for the development of mathematical talents:

Table 1. “I” - relationship type

Type of relationship "I"	**The nature of the experience**	**Mode of influence**	**Result**
I – another people	Parents, guardians, teachers, friends, family, peer group	Motivating, supportive	Human development, development of the pledges of talents
I - an object: a thing	Book, movie, game	Arousing interest, curiosity and openness to a given activity	Carrying out some activity, interest the area
I - the event, the situation together with all the context	1) An objectively positive event for a human being, 2) An objectively negative event for a person	Interest in a given activity, readiness to undertake a given area;	Interest in a given area, willingness to develop in a specific subject, in a given subject
I - success, achievement of the goal	A sense of self-efficiency, agency	I know that I can, I can, I can handle it	Continuing work in a given area, deepening your interests
I- coincidence, random event	Meeting a random person, taking part in an undertaking by chance	Strong emotional stimulus (sometimes dictated by stress); affective	Unexpected discovery, surprise element, high score achievement
I- domestic-foreign trip	Changing the environment, cultural context and customs	Strong affective factors	Getting to know something new, openness to new, faster and more effective learning, a sense of uniqueness-distinction

In analyzing the fate of mathematicians, it is important to establish the events that marked the experiences of gifted people and influenced further decisions, including those concerning the development of mathematical talents, and then making efforts and pursuing a scientific path. Since the crystallizing experience will play a special role in this text, I will present the state of knowledge that concerns it.

The crystallizing experiences

The term crystallizing experience was first used by Fieldman (1980) and then developed by Walters and Gardner (1984, p.6). According to them, each crystallizing experience is:

> ...such experiences involve remarkable and memorable contact between a person with unusual talent or potential and the materials of the field in which that talent will be manifested.

Walters and Gardner believe that a crystallizing experience may be a meeting of a creator, usually in adolescence, with representatives of a specific field of creativity or its characteristic equipment or instrumentation, which becomes a breakthrough in their life. The course of this meeting results in the fact that the creative person begins to focus their activity on the chosen field.

Walters and Gardner emphasize the fact that at the moment when the crystallizing experience appears people cannot realize that it will determine their entire life. It is not possible to identify the experience that crystallizes when it arises.

Only through personal insight (introspection) and observation of the creator in the 'post-crystallization' period can we distinguish those that result from this.

Therefore, we can distinguish two types of crystallization experiences according to Walters and Gardner (1984, pp.6-7). The characteristics of these experiences are given in the second table.

Table 2. Two types of crystallizing experiments according to Walters and Gardner (1984)

Crystallizing Experience - initial	**Crystallizing Experience -refining**
They appear in the early stages of development and signal a general similarity between the individual and the wider field of creativity.	They reveal themselves when the creator has already experienced important initiation experiences in a given field and discovers a particular approach, style or instrument within that field, to which he feels especially "attuned". They open up new perspectives and directions of activity.

The findings in the table show that in earlier developmental periods, a gifted child may discover its own predispositions and abilities thanks to good education and support from adults.

According to Walters and Gardner (1984, p.6), in the case of particularly gifted children, such discoveries often happen "as if by themselves" precisely because of initial crystallizing experiences. They claim that:

> … when such an experience occurs, which is often the case in early childhood, an individual reacts openly to some feature or property of a given field that is attractive to him (…). Later, in many cases, the individual so stubbornly sticks to this field and, using a set of highly developed appropriate intelligences, acquires great skill in a relatively short time.

Discovering the pledges of talents in early mathematics education, it is crucial in the context of the development of giftedness itself. It is important that a significant person, at an early stage of a child's development, could observe it and properly support it.

The second type of crystallizing experiences - the perfecting ones, are revealed in the sentence Walters and Gardner when the creator has already experienced important experiences in a given field and discovers a specific approach, style or specialization within the field in which he feels best. Among the mathematicians I studied, in each of the cases I analyzed, there were both initial and perfect crystallizing experiences.

Conclusion

Events that make an individual aware that they have done something perfectly or that they have done something that does not happen to others are also important. This is accompanied by a sense of uniqueness and agency. These can be events such as competitions, Olympics, but also meetings with an authority in a given field. The aforementioned authority (or role model) can appreciate this and emphasize the unique characteristics of an individual.

In conclusion, in the mathematical education of the youngest, and then adolescents, it is very important to be aware of the existence of experiences that crystallize giftedness. In this way, one can properly shape children's minds or support their development so that they use their full potential.

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References

Bühler, Ch. (1999). *The course of human life*, Państwowe Wydawnictwo Naukowe.

Feldman, D. H. (1994). *Beyond universals in cognitive development*. Ablex Publishing Corporation.

Walters, J., & Gardner, H. (1984). The Crystallizing Experience: Discovering an intellectual gift, In R. J. Sternberg, & J. E. Davidson (Eds.), *Conceptions of giftedness*, (pp.306-311). Cambridge University Press.

Wenderlich-Pintal, M. (2019). The milestones in the life course of distinguished mathematicians and mathematically gifted adolescents, *Didactica Matehmaticae* 41, 91-120, DOI: 10.14708/dm.v41i0.7027

Wenderlich, M. (2020). Crystallizing experiences in developing mathematical abilities of Polish laureates of International Mathematical Olympiad (IMO). *Proceedings of the British Society for Research into Learning Mathematics*, 40(3), 1-6. https://bsrlm.org.uk/wp-content/uploads/2021/02/BSRLM-CP-40-3-11.pdf

Wrona, M. (2015). Sytuacje graniczne w chaosie pojęciowym - próba syntezy znaczeń In J. Wiśniewska (Ed.), *Sytuacje graniczne w biegu ludzkiego życia* (pp.9-23). Wydawnictwo Naukowe Instytutu Technologii Eksploatacji - Państwowy Instytut Badawczy.