

SUMMARY OF PROFESSIONAL ACCOMPLISHMENTS

1. Name and Surname: **BARBARA BILEWICZ-KUŹNIA**

2. Diplomas, academic degrees

1993 - Bachelor's degree, three-year higher vocational studies at Maria Skłodowska-Curie University in Lublin, Faculty of Pedagogy and Psychology, major: pedagogy, specialisation: early childhood education

1995 - Master's degree, two-year master's degree programme at Maria Skłodowska-Curie University in Lublin, Faculty of Pedagogy and Psychology, major: pedagogy

2005 - PhD in pedagogy, awarded by a resolution of the Faculty of Pedagogy and Psychology at Maria Skłodowska-Curie University in Lublin. Doctoral dissertation entitled *Skuteczność wspomagania rozwoju zdolności twórczych dzieci sześcioletnich (The effectiveness of supporting the development of creative abilities in six-year-old children)*, thesis supervisor: dr hab. Sabina Guz; reviewers: dr hab. Józefa Bałachowicz, prof. Stanisław Popek, PhD

3. Information about employment to date in academic institutions

1995-2006	Maria Skłodowska-Curie University in Lublin, the Faculty of Pedagogy and Psychology, position: teaching and research assistant in the Department of Preschool Education
2006 - present	Maria Skłodowska-Curie University in Lublin, the Faculty of Pedagogy and Psychology, position: assistant professor in the Department of Preschool Education
2009-2013	MCSU Teacher Training College in Radom; position: teacher
2008-2018	Janusz Korczak Pedagogical University (formerly: Towarzystwo Wiedzy Powszechnej/Society for the Popularization of Culture and Science Pedagogical University) in Warsaw, the Branch in Lublin; employed on commission contract and task-specific contracts

4. The accomplishments resulting from Art. 16 sec. 2 of Act of 14 March 2003 on academic degrees and academic title as well as degrees and title in art (Journal of Laws, 2003 No. 65, item 595, consolidated text, Journal of Laws, 2017, item 1789)

4.1. The title

**Rozwijanie umiejętności matematycznych dzieci w wieku przedszkolnym/
Developing the mathematical skills of preschool-aged children**

Bilewicz-Kuźnia B. (2018a). *Rozwijanie umiejętności matematycznych dzieci w wieku przedszkolnym* [Developing the mathematical skills of preschool-aged children]. Lublin: UMCS Publishing House, pp. 448; reviewer Prof. UW, PhD Małgorzata Żytko.

4.2. Discussion of the scientific purpose of the above-mentioned work(s) and obtained results, as well as the discussion of their potential use

The objective of teaching and learning mathematics is to build individuals' knowledge, to develop skills, to get to know techniques and algorithms which are useful in everyday life. Unfortunately, the practised tradition of teaching mathematics often inadequately presents the capabilities of the subject exploring this area of knowledge, and thus perpetuates certain standards of functionalist and behaviouristic education. This tradition is dominated by a transfer of knowledge and the teaching of rules. The critical-creative or constructivist discourse of mathematical education is poorly rooted in the reality of schools and preschools. Innovative methodological solutions or new programmes of early mathematical education are introduced with a great dose of caution. Moreover, the situation is made more difficult by the lack of the practice of verifying curricula, not only in Poland, but also abroad [Clemens, 2007].

The monograph [Bilewicz-Kuźnia, 2018a] is a verification of the original functional teaching-based project *Matematyczny dar/Mathematical Gift*, designed for six-year-old children and implemented in the preschool reality in an experimental study, and an attempt to describe the context of this undertaking in ethnographic research. Therefore, the publication is at the same time an analysis and a report from two independent studies conducted according to distinct research designs, though in the same place.

The aim of the experimental study was to determine the influence of the functional teaching-based project *Matematyczny dar/Mathematical Gift*, which employs a constructivist approach in education, on the level of development of mathematical skills in six-year-old children. The aim of the qualitative ethnographic study was related to the author's intention to examine the context and conditions of experimental influences in more detail, including the determination of factors which favoured or hampered the effectiveness of didactic intervention. The essence of the study was also to acquire the knowledge about the manifestations of children building physical and logical-mathematical knowledge, as well as mathematical and creative activities.

The research problems formulated on the plane of the quantitative study comprise the main research problem: Does the implemented functional teaching-based project *Matematyczny dar/Mathematical Gift* affect the development of mathematical skills in six-year-old children, and to what extent?, as well as two sub-problems:

- a) Does the functional teaching-based project *Matematyczny dar/Mathematical Gift* affect the development of mathematical skills (knowledge of numbers, spatial and temporal orientation) in children from group E as compared to children from group C, and to what extent?
- b) Does the functional teaching-based project *Matematyczny dar/Mathematical Gift* affect the development of geometry skills (knowledge of geometric shapes and ways of measuring) in children?

The key scientific assumption verified in the quantitative research assumed the form of the main hypothesis (H): The implemented functional teaching-based project *Matematyczny dar/Mathematical Gift* has a favourable effect on the development of mathematical skills in six-year-old children.

The causative effect of the experimental factor was evaluated from the angle of two detailed assumptions: the implemented functional teaching-based project has a favourable effect on the development of mathematical skills in children in terms of knowledge of numbers and the ability to use them, as well as spatial and temporal orientation (H1); the implemented functional teaching-based project has a favourable effect on the development of geometry skills, including knowledge of geometric shapes and simple ways of measuring (H2).

The experiment employed the method of random purposive sampling. Purposive sampling took into account: the age of children (six years), type of family, type of preschool

institution, educational and cultural environment, the period of attending preschool, intellectual level, readiness for learning mathematics, linguistic and motor skills. Purposively selected groups were then randomly divided into two equinumerous (45 persons each) groups: experimental (E) and control (C).

In testing children's mathematical skills, the following were used: Urszula Oszwa's LPC6 Scale (2006) and the author's *Tests in geometry skills*. In testing control variables, the following were used: Raven's Progressive Matrices, a series of tasks for testing maturity in terms of the operational strategy of cognition, Helena Siwek's *Puzzles*, Zbigniew Tarkowski's *Test of linguistic abilities*, Tests for evaluating manual skills. After pre-testing, the experimental factor was introduced to group E in the form of an independent variable - functional teaching-based project *Matematyczny dar/Mathematical Gift*.

Initial research conducted before the introduction of the experimental factor demonstrated that the differences in the levels of the development of mathematical skills between the children from the experimental group and those from the control group were not statistically significant. The original project *Matematyczny dar/Mathematical Gift* involved a cycle of didactic activities with children conducted twice a week, a game and special events. The activities were characterised by the use of constructivist didactic strategies (cognitive conflict, solving mathematical tasks and problems using linguistic tools and means; spatial-visual modelling; exploratory activities, investigating, experimenting; group work; construction games; summary talks; an analysis of the photos of children's works; exhibitions, presentations, conversations). The project took into account the organisation of material and emotional conditions which affect the learning process. In the experimental group, a space with Froebel's educational materials was provided. Emotional conditions took into consideration the concern for appropriate communication, children's psychological comfort and involvement.

The effectiveness of educational influence was measured by comparing changes in various areas of mathematical skills between the start of the educational project (pre-test) and its end (post-test). In order to exclude the developmental factor, as well as independent educational influence of preschool and family environment, it was analysed to what extent the change in general mathematical competences, observed in the experimental group (subjected to a different educational process) differed from the "natural" change in the same area observed in the control group (subjected to a classical influence).

The final test, conducted after the experimental influences had finished, and the accompanying detailed quantitative analysis, demonstrated that favourable changes in the process of gathering experiences and the ensuing increase in mathematical skills occurred both in the experimental and control group.

The main hypothesis (H) concerning the favourable effect of the functional teaching-based project *Matematyczny dar/Mathematical Gift* on six-year-old children's mathematical skills was confirmed by the study. The six-year-old children who participated in the project showed significantly higher general achievements in terms of mathematical skills related to understanding numbers, space and time than children from group C. An overall analysis demonstrated the significance of the interaction effect, and not of the main effect of the repeated test. The increase in the level of performing tasks in the second measurement was significantly greater in the experimental group.

In spite of the fact that favourable developmental changes occurred in both groups (E and C), as a result of implementing the functional teaching-based project these changes were significantly greater in the experimental group.

As far as detailed skills are concerned, or the ability to count (Co), understand space (S) and time (T), statistically significant differences between the development of skills in groups E and C was observed in terms of spatial skills (S). In relation to the ability to use numbers

(Co) and understand time (T), no such differences were observed between groups; therefore, the sub-hypothesis H1 is not fully confirmed.

The evaluation of the skill of counting (Co) did not return any statistically significant effects; moreover, the interaction effect between the experimental condition (group) and a repeated measurement with a subscale (numbers), which was the most important from the point of view of the hypotheses, turned out to be insignificant. As a result of didactic influence based on methodology of constructivist approach, there were no statistically significant differences between groups in terms of competencies related to counting. A favourable process of development of counting skills occurred in both groups. However, the changes in each of the groups were of different character. While in the preliminary test the groups were statistically significantly different only in terms of the narrow skill of counting in twos (in favour of group E), the final test demonstrated that these differences, also in favour of group E, concerned two areas of the ability to count: formulating and solving mathematical problems involving addition and doing arithmetic operations related to subtraction.

In relation to spatial orientation (S), the analysis of variance conducted for the space subscale revealed a significant interaction effect between the experimental condition and the repeated measurement of the result. In spite of the fact that positive changes in terms of the development of skills related to spatial orientation occurred in both groups, it was in the experimental group that they were more powerful. The biggest differences in terms of developmental changes which occurred within the space of a few months in groups E and C concerned the following skills: distinguishing the shapes of plane and spatial figures, spatial orientation (the ability to point to objects which are to the left/right of...), orientation in the pattern of one's own body, pointing to the left arm/leg, understanding spatial relations between objects.

The understanding of time measured in the cycles of seasons and days of the week was significantly developed in all the children, both from group E and C. An interesting finding was related to an increase in certain mathematical skills in the experimental group, with an insignificant increase in the control group. It concerned considerably more difficult skills, that is: comparing units of time, the knowledge of correct names and order of days of the week, using the names of the months and understanding the cycle of the year.

In terms of spatial orientation, the experiment confirmed the favourable effect of the *Matematyczny dar/Mathematical Gift* project on the related skills, especially in terms of distinguishing the shapes of plane and spatial figures (based on the example of a circle and a ball), spatial orientation (the ability to point to objects which are to the left/right of...), orientation in the pattern of one's own body (pointing to the left arm/leg), understanding spatial relations between objects.

H2 hypothesis was also confirmed. After the experiment was finished, a vast majority of children from group E knew and were able to recognise more geometrical shapes (a circle, rectangle, triangle, square, ball, cylinder, and more than a half of the studied subjects - a cube). Children from group C knew fewer geometrical shapes (mostly a circle, rectangle, square; a significantly lower percentage of the studied subjects recognised a triangle, cylinder, ball; very few of them - a cube). The final test also revealed an increase in the competence in measuring, both in the children from group E and C. However, this increase was more dynamic and favourable in the experimental group. In the final test, children from group E demonstrated a much better knowledge of types of things, tools and objects intended for measuring, as they were able to enumerate as many as six types (measuring tape, set square, protractor, ruler, cube, tile), as compared to children from the control group (measuring tape, ruler, string).

Moreover, the study confirmed that general mathematical skills are related to the level of development of operational reasoning and linguistic proficiency.

The second simultaneously undertaken study described in the monograph is of ethnographic nature and it allowed the author to describe the context and the hidden dimensions of the examined phenomenon. The research problems formulated on the plane of the quantitative study were as follows:

- a) What are the manifestations of building physical and logical-mathematical knowledge in children participating in the *Matematyczny dar/Mathematical Gift* project?
- b) What are the manifestations of children creatively using Froebel's educational materials?
- c) What is the context of the functional teaching-based project?

The study revealed that through individual and direct activities with objects, the children participating in the project discovered physical and logical-mathematical principles and built their knowledge in these areas. Froebel's educational materials were mainly used by children for playing, but they also became a tool for representing reality. Three types of creative strategies in contact with educational materials were determined: experimenting, introducing geometric order (creating rhythms and pictures) and narrating. The children who participated in the project significantly increased their competencies in building complex constructions, which was reflected in their ability to build three-dimensional constructions with movable elements and closed with a ceiling. It was also observed that there was a better communication and cooperation between children that took into account narrations in which mathematical language was present.

Studying the context, the factors were determined which influenced the course and effects of the processes of teaching and learning in preschool and of the implemented methodological influence. These were: the conditions and the function of the preschool classroom, the organisation of the preschool year, including the rituals, events and celebrations in the preschool, the daily schedule, physical space and educational materials, the attitude of the employees and their educational strategies.

It was concluded that the context of the process of gathering experiences by children can be fundamentally described by two extreme dimensions: positive and negative. The characteristics of the positive dimension are as follows: friendliness and support (of other persons) and availability (of materials, spaces for exploration). The characteristics of the negative dimension are as follows: unavailability, unfriendliness and imposing limits. Unlimited access to materials and spaces of cognitive explorations guarantees that the need for action is fulfilled. Favourably arranged space ensures progress. It is also ensured, or maybe even above all, by a positive, friendly attitude to children, the methodological initiative and the materials (especially those introduced by an outsider). A positive attitude of subjects creates positive conditions for change and ensures the necessary synchronisation of methodological activities. On the other hand, a negative attitude does not build relationships or bonds, does not guarantee anyone present in this space comfort of activity or closeness in relationships. Between the positive and negative dimension, there is also an intermediate space, where educational materials are available, but under certain conditions, and the persons in the preschool have an ambivalent and overcautious attitude. A positive attitude and friendliness (in terms of the availability of materials and persons, as well as the accompanying strategies) are the factors which favour the development of all the involved subjects and create a good atmosphere for the development of methodological initiatives. On the other hand, negative attitudes and approaches, an arrangement of space which does not favour activities, unfavourable didactic measures - hamper, stifle and, what is more, block children's activeness and limit even the best prepared didactic initiative. With a friendly atmosphere and in the conditions of recognising and respecting the child's needs (mainly lower-order needs and cognitive needs), as well as his or her individuality, it is possible to implement new didactic initiatives in an efficient and satisfactory way, and thus obtain greater progress in the child's development.

The functional teaching-based project *Matematyczny dar/Mathematical Gift* is an example of a favourable effect of an alternative methodological concept of early mathematical education intended for older preschoolers. It was empirically confirmed that children's mathematical education based on the functional method of teaching and on employing Froebel's educational materials has a favourable effect on an increase in general mathematical skills, and particularly in geometry and spatial skills. It causes a more dynamic increase in the ability to orientate oneself in space, to recognise geometric shapes and to measure.

Implementing a new methodological project to the preschool environment is related to a system of many mutual dependencies. The results of methodological activities are strongly affected by the existing, co-created and changing physical and personal space of the preschool. The study demonstrated that implementing methodological projects and innovations is most effective in favourable conditions, such as the child's psychological comfort and respecting his or her needs, adequately organised and accessible physical space, including available materials for individual exploration, in a friendly and cooperative personal environment. The further use of the research has a scientific as well as practical dimension. It can be related to implementing the developed methodological proposals (described in detail in the annex) in the preschool reality, thus providing ways, verified in practice, of using Friedrich Froebel's materials in the constructivist model of educational support. Moreover, the present research opens up spaces for more experimental studies and action research. In order to ensure the most favourable educational conditions possible, the following should be considered before undertaking new projects: the conditions of the effectiveness of influences, internal (e.g. emotional attitude, pedagogical orientation) as well as external (e.g. organisation of space, daily schedule) conditions of learning in preschool.

The employed procedure allows for repeating the research and verifying the suggested solutions in various socio-cultural environments, as well as in early-school education. The conclusions from the research, providing new knowledge about conditions and contexts of introducing innovations and conducting experiments, can be useful for subsequent researchers-innovators and create a new perspective for explaining the related phenomena.

4.3. Other academic and research accomplishments

Preschool pedagogy constitutes the fundamental area of my over twenty-year-long scientific, research and didactic interests. Their main subject is:

Preschool education - conditions, effects and methodological solutions.

Research interests in this area can be divided into the following thematic blocks:

- 1. Supporting children's development in innovative education based on Froebel's ideas.**
- 2. Early geometric education.**
- 3. Identifying and supporting children's creative potential.**
- 4. Preschool teachers, their working styles and needs.**
- 5. Determinants and contexts of preschool education.**

1. Supporting children's development in innovative education based on Froebel's ideas

Innovative and experimental education is focused on supporting and maximising children's development. It is also aimed at freeing pedagogical practice from routine,

unification of contents and cognitive passivity of its participants. The undertaken research explorations constituted a response to these needs and an attempt to find an answer to the conclusions of numerous 21st-century studies which are critical of didactic and educational strategies and styles of the modern preschool and school practice.

Taking into account the need to promote humanistic education, support children's autonomy and their need to decide about their own development, the object of my research was the verification and description of original solutions concerning the curriculum, organisation and methodology in preschool practice. The solutions I developed refer to the pedagogical thought of the great reformer - "the father of preschool education," Friedrich Froebel (1782–1852), his idea of education (a vision of the child as an active subject operating in the socio-cultural environment; education based on playing and on teaching through playing) and educational materials called "gifts." This thematic block includes research projects related to the implementation of curriculum-organisational-methodological innovations: *Dar zabawy (The Gift of Play)*, *Esy floresy (Doodles)*, *Zabawa heurystyczna (Heuristic Play)*, as well as theoretical and methodological publications about Froebel's pedagogical concept, in total 1 monograph, 9 scientific articles (including two in English) and theoretical-methodological studies used in conducting action research (curriculum of preschool education, a methodological handbook and a collection of games).

An important area of interest for me has been play, an intrinsic feature of childhood which occupies a special place in Froebel's pedagogical thought. The phenomenon of this activity was described in a monograph I edited [Bilewicz-Kuźnia (ed.), 2017]. It includes two chapters which I am the author of (one concerning the theory of play according to the contemporary Froeblian scholar Tina Bruce; the other concerns heuristic play according to Elinor Goldshmid [Bilewicz-Kuźnia, 2017d]. This thematic block also includes the article about the place of play in education [Bilewicz-Kuźnia, 2015c]. Due to the fact that preschool pedagogy is a practical science, I also produced publications and developed methodological materials for preschools related to free play and teacher-directed play.

Publications from the area of: Supporting children's development in innovative education based on Froebel's ideas

Monograph:

Bilewicz-Kuźnia B., ed. (2017). *Zabawa i zabawka. Konteksty, wartość, znaczenia* [Play and toy. Contexts, value, meanings] Lublin: UMCS Publishing House, pp. 281.

Articles:

1. Bilewicz-Kuźnia B. (2013). *Historyczny i współczesny obraz edukacji przedszkolnej według koncepcji Friedricha Wilhelma Fröbela* [Historical and contemporary image of preschool education according to the idea of Friedrich Wilhelm Froebel]. In: T. Parczewska, B. Bilewicz-Kuźnia (ed.), *Edukacja przedszkolna w Polsce i na świecie. Wybrane zagadnienia* [Preschool education in Poland and abroad. Selected questions]. Lublin: UMCS Publishing House, pp. 39–56.
2. Bilewicz-Kuźnia B. (2015a). *Przystosowanie psychospołeczne i współpraca rówieśnicza dzieci działających w małych grupach* [Psychosocial adaptation and peer cooperation between children working in small groups] In: J. Uszyńska-Jarmoc, M. Bilewicz (ed.), *Kompetencje kluczowe dzieci i młodzieży. Teoria i badania* [Key competencies of children and youth. Theory and research]. Warsaw: Academic Publishing House Żak, Fundacja Centrum Transferu Wiedzy i Innowacji Społeczno-Pedagogicznych [Foundation Centre for Transfer of Knowledge and Social and Pedagogical Innovation], pp. 185–204.
3. Bilewicz-Kuźnia B. (2015c). *Zabawa i nauczanie przez zabawę w podstawie programowej i wybranych programach wychowania przedszkolnego* [Play and playful teaching in curriculum

- framework and selected preschool curricula]. *Edukacja Elementarna w Teorii i Praktyce* [Elementary Education in Theory and Practice], no 4(38), s. 13–39 (MNiSW B LIST).
4. Bilewicz-Kuźnia B., Centner-Guz M. (2015). *Natura, architektura i zabawa jako źródła przeżyć estetycznych i odkryć geometrycznych dzieci – badania w działaniu* [Nature, architecture and play as sources of aesthetic experiences and geometric discoveries]. *Problemy Wczesnej Edukacji* [Issues in Early Education], no 11/4(31), pp. 101–121 (MNiSW B LIST).
 5. Bilewicz-Kuźnia B. (2016c). *Places, toys, and activities observed in the course of children's free play in preschool*. *The New Educational Review*, vol. 44, no 2, s. 257–269 (ERIH PLUS LIST, MNiSW B LIST).
 6. Bilewicz-Kuźnia B. (2017a). *Odkrywanie własnych możliwości twórczych i nowych (prze)znaczeń przedmiotów w zabawie* [Discovering own creative possibilities and new (re) meanings of objects in play]. W: B. Bilewicz-Kuźnia (ed.), *Zabawa i zabawka. Konteksty, wartość, znaczenia* [Play and toy. Contexts, value, meanings]. Lublin: UMCS Publishing House, pp. 229–244.
 7. Bilewicz-Kuźnia B. (2017b). *Renesans poglądów pedagogicznych Friedricha Froebela w wychowaniu przedszkolnym XXI wieku – badania w działaniu* [A renaissance of Friedrich Froebel approach in XXI century preschool education - action research]. In: M. Nawrot-Borowska, D. Zajac (ed.), *Dziecko i dzieciństwo. Wybrane konteksty badań* [A child and a childhood. Selected research contexts] Bydgoszcz: Uniwersytet Kazimierz Wielki Publishing House, pp. 195–209.
 8. Bilewicz-Kuźnia B. (2017c). *The experimental approaches and creative mindsets of children in heuristic play*. *Agathos. An International Review of the Humanities and Social Studies*, vol. 8(2), pp. 197–212 (ERIH PLUS LIST).
 9. Bilewicz-Kuźnia B. (2018b). *Zabawa życiem dziecka – aplikacja teorii Froebela do praktyki przedszkolnej XXI wieku* [Play as a child's life - application of Froebel's theory to the preschool practice of the 21st century]. *Forum Pedagogiczne*, no 2 (MNiSW B LIST).

Methodical publications:

1. Bilewicz-Kuźnia B. (2014a). *Dar zabawy. Metodyka i propozycje zajęć z dziećmi według założeń pedagogicznych Froebela* [The gift of play. Methodical guide and proposals of classes with children according to the idea of Froebel]. Lublin: Froebel.pl Publishing House, pp. 287.
2. Bilewicz-Kuźnia B. (2014b). *Dar zabawy. Program wychowania przedszkolnego* [The gift of play. Curriculum]. Lublin: Froebel.pl Publishing House, pp. 135.
3. Bilewicz-Kuźnia B. (2016a). *Dar zabawy. Program wychowania przedszkolnego* [The gift of play. Curriculum], 2 edition. Lublin: Froebel.pl, Publishing House, pp. 159.
4. Bilewicz-Kuźnia B., Kustosz S., Małek K. (2017). *Dar zabawy. Program wychowania przedszkolnego*. [The gift of play. Curriculum], 3 edition Lublin: Froebel.pl Publishing House, pp. 185.
5. Bilewicz-Kuźnia B. (2018c). *Zabawy z matą* [Games with the mat]. Kielce: MAC Education Publishing House, pp. 48.

The most important research projects related to this area are as follows:

The Gift of Play project - action research

The aim of the undertaken study [Bilewicz-Kuźnia, 2017b] was to create the most favourable and stimulating conditions of development and creative self-fulfilment for the subjects involved in the research, as well as to cause positive changes in terms of their activities, creative attitudes and competencies. The most important practical aim of the research was to introduce a complete innovation in terms of curriculum, organisation and methodology, *Dar zabawy/The Gift of Play*, in a number of preschools in Lublin.

I was looking for an answer to the following problem: Will introducing the pedagogical innovation *Dar zabawy/The Gift of Play* (which involves a distinct model of organisation of work in the preschool, a new curriculum, educational methods and materials) cause positive

individual changes in the subjects involved in it (mainly children and teachers), as well as broader changes with greater social outreach? To what extent?

The innovation was implemented in the school year of 2013/2014 in 5 preschool groups, involving over 200 six-year-old children, about 50 teachers and 10 pedagogy students. In the groups working with the innovation, a holistic model was employed with an orientation towards free play, including so-called heuristic play, children working in small groups, cognitive activities using Froebel's educational materials, return to traditional handicraft (e.g. handicraft with peas, paper folding) as well as cleaning, domestic and socially useful work; musical and physical activities, such as physical games in a circle; outdoor education; exploring the world in a direct way. The study demonstrated [Bilewicz-Kuźnia, 2015a] an increase in social competencies of children from the "Froebel's" groups, e.g. a lower level of withdrawal, and highly developed features such as tactful behaviour, sociability, persistence and concentration.

Innovative activities activated the research and creativity potential in the persons involved in them and became the the beginning of a sort of renaissance of Froebel's pedagogy in Poland. For my work on this project, in 2016 I was awarded the title of the "Edu-inspirer of the Year 2015" by Fundacja Rozwoju Systemu Edukacji (the Foundation of the Development of Educational System).

Thanks to conducting this research, preschool institutions initiated and implemented many new initiatives in their educational reality. New communities, actively involved in developing Froebel's pedagogy, were created (Froebel.pl; zafreblowani.pl). In the Institute of Pedagogy at MCSU, a training course of Froebel's pedagogy for teachers was launched (<https://www.umcs.pl/pl/aktualnosci,59,kurs-freblowski,37562.chtm>); a new subject was included in the curriculum of pedagogical studies called "Friedrich Froebel's pedagogy;" a number of training seminars for teachers were organised.

The results of the present study can be used in comparative research into education pursued according to distinct original and alternative didactic models, as well as in future research into the effectiveness of constructivist education employing Froebel's pedagogical thought. Their value has a practical dimension. They provide an example of creating adequate conditions for supporting children's development and social competencies, which are especially needed today. They demonstrate how to create educational reality orientated towards greater originality of teachers' pedagogical thought and promoting original ideas which support the development of children's competencies.

Zabawa heurystyczna/Heuristic play project - a qualitative study

According to Froebel's concept, play is the life of a child and the fundamental mechanism of his or her multilateral development. For this reason, the subsequent research project concerned this form of activity in the child's life, which at the same time constitutes a method of didactic influence. I evaluated the actual situation concerning toys, places and activities of preschool-aged children in play by undertaking a qualitative study conducted by the means of observation, whose results were described in the article *Places, toys, and activities observed in the course of children's free play in preschool* [Bilewicz-Kuźnia, 2016v].

The aim of this research was to attempt to determine the material and emotional conditions for free play in Polish preschoolers, and the course of play activities depending on the time of day. The following questions were of interest to me in the study: which places and toys are chosen by children for their play during their stay at preschool; if there are any differences in terms of play activities in the morning and in the afternoon; what types of play children engage in at preschool; if the types of play differ depending on the time of day; what social interactions between children look like in free play; what the role of teacher in play is.

The main research method was observation conducted using the time sampling technique with time intervals of approximately one hour. In total, 38 observation sessions were conducted in which 854 children participated, aged 3-6, pupils of urban and rural preschools in Lublin Voivodeship in Poland. Research results assumed the form of a few conclusions, for example: during the time intended for free play, children engage mostly in construction and theme play; children assign themselves playing roles on their own; they play in different places of the preschool room; they have free access to various toys, educational materials and props. They use many more toys and are more active in their play in the morning and before noon than in the afternoon. During children's free play, a large proportion of teachers are busy with organisational activities and with completing documentation. It is only rarely that they conduct purposeful and planned observation and maintain friendly control over play during that time. Usually, teachers spend it preparing didactic classes or checking pupils' written works. A strong pressure to prepare the children for school well and "paper teaching" block the propagation of free play, to which more time should be devoted, especially in the afternoon and in the whole preschool area, including the outdoors.

These conclusions prompted me to conduct new research related to play and focusing on the so-called heuristic play, which was described in the articles [Bilewicz-Kuźnia, 2017a, 2017c].

Heuristic play is a type of play described by Froebel's pedagogy scholar Elinor Goldschmied [Goldschmied, Jackson 1994]. The study was of qualitative character. The aim of the observation was to identify children's creative approaches and attitudes, as well as to describe their cognitive and exploratory activities undertaken in free play with waste materials, everyday objects and natural objects, kept in labelled bags or baskets. On the basis of the collected data, a few types of children's exploratory approaches and creative attitudes revealed in heuristic play were identified. Taking into account the character of the child's cognitive contact with objects, the approaches which were observed are as follows: a general investigative approach, an exploratory approach (an explorer), and perceiving objects in a more specific way, through the prism of numbers, shapes and forms or meanings (an enumerator, a master of structures or meanings). In developed games, various kinds of conceptual approaches to play and in play could be observed. The following attitudes were observed: an initiator, imitator, creator of meanings, reorganiser. Due to various styles of playing, in accordance with C. Jung's achievements, two psychological types were distinguished: an introvert and an extrovert. Apart from these, the following attitudes were manifested: a pedant, adventurer, instructor, altruist. These approaches were not mutually exclusive.

The study described in the chapter [Bilewicz-Kuźnia, 2017a] allowed for enumerating children's exploratory activities and introducing a new practice of playing with waste materials to preschool education. The results may give rise to further research on creative attitudes and approaches revealing in play, also considered in the light of other psychopedagogical theories.

Esy floresy/Doodles project - action research

One of the first studies inspired with Froebel's educational materials and pedagogical thought was participatory action research, based on introducing new educational materials *Esy floresy/Doodles* to preschool practice and examining their effectiveness in the process of supporting children's geometric and artistic education. The results of this research were described in the article [Bilewicz-Kuźnia, Centner-Guz, 2015].

Esy floresy/Doodles blocks, designed for educational purposes and employed in the study, were awarded a distinction in "The Innovative Educational Toy 2016" competition.

The aim of the study was to verify in practice the methodological proposal of artistic-mathematical classes in preschools and to test the usefulness of the newly designed materials in preschool work. Another important aim of the study was to activate the creativity of researchers, children and teachers. The research questions in this study were as follows: How will joint activities of researchers, the teacher and children using new educational materials proceed? Will the proposed activity with the educational material trigger geometric intuition and creativity? To what extent? How will research participants evaluate the activities and educational materials?

The study group consisted of 25 children aged 5-6. The activities were conducted in the preschool on a regular basis, during a period of a few weeks, before noon. The study demonstrated that blocks are an example of an educational material which effectively supports the development of spatial and creative thinking, both in free and directed activities. It was verified that they are a teaching measure which enables pupils to make observations concerning shapes, sizes, space and numbers and which develops children's imagination. The blocks favour unlocking geometric intuition, are helpful in the process of learning the principles of regularity governing sequences, in understanding the terms of symmetry and asymmetry; they provide an opportunity for aesthetic experiences. Interactions with *Esy floresy/Doodles* blocks favour building positive relationships with others and contribute to creative changes in the educational reality.

Methodological publications which I included in this area of interests were closely linked to the conducted action research.

Conducting research related to Froebel's pedagogical thought and the materials he developed, I simultaneously conducted literature studies in this area, which contributed to writing two theoretical works on the subject [Bilewicz-Kuźnia, 2013, 2018b]. I participated in conferences organised by Froebel associations abroad [Bilewicz-Kuźnia, 2014d] and I consulted my projects with members of foreign associations: Froebel Trust UK and Froebel USA.

2. Early geometric education

Basing on the assumption that mathematical thinking, including spatial thinking, is a predictor of an individual's future achievements, important for such disciplines as science, technology, engineering, art and mathematics (STEAM), I also focused my interests on issues which have not been thoroughly examined, related to geometry, or, more precisely, early geometric education. The effects of my theoretical explorations and conducted research were published in a form of a monograph, which constitutes a theoretical study containing methodological proposals, and in 5 scientific articles, including one in English. The monograph entitled *Edukacja geometryczna dzieci/Geometric education of children* [Bilewicz-Kuźnia, 2014c] consists of six chapters. It analyses the place of geometry in pedagogical concepts and curricula; the psychopedagogical foundations of the shaping of geometric intuitions in childhood; characteristics of children's dispositions towards learning mathematics and geometry; the ways and conditions of exploring the world in geometric terms. It also includes examples of practical solutions related to building geometric notions in children's minds. The remaining publications in this area are mainly of theoretical character. Two of them were published in foreign post-conference materials.

Publications from the area of: Early geometric education

Monograph:

Bilewicz-Kuźnia B. (2014c). *Edukacja geometryczna dzieci* [Geometric education of children]. Lublin: UMCS Publishing House, pp. 260.

Articles:

1. Bilewicz-Kuźnia B. (2010a). *Kształtowanie pojęć matematycznych na etapie wczesnej edukacji* [Forming mathematical concepts at the early education stage]. In: T. Parczewska (ed.), *Psychopedagogiczne aspekty rozwoju i edukacji małego dziecka* [Psychopedagogical aspects of the development and education of a small child]. Lublin: UMCS Publishing House, pp. 125–145.
2. Bilewicz-Kuźnia B., Parczewska T. (2010c). *Kształtowanie pojęć matematycznych na etapie edukacji elementarnej* [Forming mathematical concepts at the elementary education stage]. In: *Matematika 4. Matematické vzdělávání v kontextu proměn prymární školy. Sborník příspěvků z konference s mezinárodní účastí*. Olomouc: Univerzita Palackého v Olomouci, pp. 52–56.
3. Bilewicz-Kuźnia B. (2011b). *Geometria w edukacji dzieci* [Geometry in children's education]. In: M. Karwowska-Struczyk, D. Sobierańska, M. Szpotowicz (ed.), *Pedagogika przedszkolna i wczesnoszkolna. Badania, opinie, inspiracje* [Pre-school and early-school education. Research, opinions, inspirations]. Warsaw: Academic Publishing House Żak, pp. 274–294.
4. Bilewicz-Kuźnia B. (2012a). *Geometria w edukacji najmłodszych – odcinek na ścieżce, dekoracja czy dar zapomniany?* [Geometry in education – length of the way, decoration or forgotten gift]. In: M. Kowalik-Olubińska (ed.), *Dzieciństwo i wczesna edukacja w dynamicznie zmieniającym się świecie*. [Childhood and early education in a dynamically changing world]. Toruń: Adam Marszałek Publishing House, pp. 301–320.
5. Bilewicz-Kuźnia B. (2012c). *The essence of ways and conditions in which children explore the world of geometry*. W: A. Prídavková, M. Klimovič (eds.), *Komplexnost' a integrita v predprimárnej, primárnej, a specialnej edukácii. Zborník príspevkov z vedeckej konferencie s medzinárodnou účasťou*, Prešov 20–22.09.2012. Prešov: Vydavateľstvo Prešovskej Univerzity, pp. 227–234.

3. Identifying and supporting children's creative potential

The area of interests related to studying the specificity of identifying creative skills and the processes of supporting their development constituted a continuation of my interests which are the subject of my doctoral dissertation. Within this area, I identified the needs and problems related to supporting children's creative potential, as well as social and emotional competencies of artistically gifted children. Moreover, I also addressed the issue of diagnosing artistically gifted children; I conducted an analysis of programmes of boosting artistic skills, and I developed projects of supporting creative competencies.

Publications from the area of: Identifying and supporting children's creative potential

1. Bilewicz-Kuźnia B. (2005). *Zdolności intelektualne a myślenie twórcze dzieci sześciolatek* [Intellectual abilities and creative thinking of six-year-old children]. In: S. Guz (ed.), *Rozwój i edukacja dziecka. Szanse i zagrożenia* [Development and education of a child. Chances and dangers]. Lublin: UMCS Publishing House, pp. 265–274.
2. Bilewicz-Kuźnia B. (2008a). *Jak przedszkole może wspomagać rozwój twórczej aktywności – na podstawie doświadczeń brytyjskich* [How a kindergarten can support the development of creative activity - based on British experience]. *Wychowanie na co dzień*, no 1–2, pp. 34–36.
3. Bilewicz-Kuźnia B. (2008b). *Programy pobudzania twórczej aktywności jako profilaktyka postawy konsumpcyjnej u dzieci* [Programs of stimulating creative activity as a prevention of consumer childrens attitude]. In: S. Guz, J. Andrzejewska (ed.), *Edukacja wobec zagrożeń rozwoju i bezpieczeństwa dzieci* [Education in the face of threats to the development and safety of children]. Lublin: UMCS Publishing House, pp. 153–165.
4. Bilewicz-Kuźnia B. (2008c). *Skuteczność wspomagania rozwoju zdolności twórczych dzieci sześciolatek poprzez wykorzystanie autorskiego programu eksperymentalnego* [Effectiveness of supporting the development of creative abilities six-year-old's children through using author's experimental program]. In: J. Łaszczyk, M. Jabłonowska (ed.), *Uczeń zdolny wyzwaniem dla*

- współczesnej edukacji [A gifted student as a challenge of contemporary education]. Warsaw: Akademy of Special Education Publishing House, pp. 294–302.
5. Bilewicz-Kuźnia B. (2009a). *Identyfikowanie uzdolnień twórczych u dzieci w wieku przedszkolnym* [Identifying creative talents of pre-school children]. In: J. Łaszczyk, M. Jabłonowska (ed.), *Zdolności i twórczość jako perspektywa współczesnej edukacji* [Abilities and creativity as a perspective of modern education]. Warsaw: Universitas Rediviva Publishers, pp. 137–145.
 6. Bilewicz-Kuźnia B. (2009b). *Sposoby komunikowania się rodzica z dzieckiem w różnych sytuacjach społecznych* [Ways of communication between a parent and a child in different social situations]. In: M. Baryluk, M. Wawrzak-Chodaczek (ed.), *Wartości w komunikacji różnych grup społecznych* [Values in communication of different social groups]. Toruń: Adam Marszałek Publishing House, p. 32–45.
 7. Bilewicz-Kuźnia B. (2009c). *Wybrane społeczne i emocjonalne umiejętności dzieci o wysokich predyspozycjach twórczych* [Selected social and emotional skills of children with high creative predispositions]. In: S. Włoch (ed.), *Wczesna edukacja dziecka – perspektywy i zagrożenia* [Early Childhood Education - Perspectives and Threats] Opole: Opole University Publishing House, pp. 331–338.
 8. Bilewicz-Kuźnia B. (2010c). *Praca z dzieckiem zdolnym – potrzeba, rzeczywistość, uwarunkowania skuteczności* [Work with a gifted child - need, reality, determinants of effectiveness]. In: *Klíčové kompetence a jejich reflexe v přípravě učitelů primárního vzdělávání. Sborník příspěvků z konference s mezinárodní účastí*. Liberec: Technická Univerzita v Liberci, pp. 25–31.
 9. Bilewicz-Kuźnia B. (2010d). *Sposoby rozpoznawania zdolności i zainteresowań u dzieci w wieku przedszkolnym* [Ways of recognizing abilities and interests of pre-school children]. In: E. Marek, J. Łuczak (ed.), *Diagnoza i terapia psychopedagogiczna w edukacji dziecka* [Diagnosis and psychopedagogical therapy in child education] Piotrków Trybunalski: Scientific Publishing House, pp. 281–290.
 10. Bilewicz-Kuźnia B. (2011c). *Wspieranie uczniów klas 0–III w rozwoju zdolności i uzdolnień – rzeczywistość, potrzeby, problemy* [Supporting students of grades 0-III in the development of abilities and talents - reality, needs, problems]. In: E. Skrzetuska (ed.), *Problemy edukacji wczesnoszkolnej. Indywidualizacja, socjalizacja, integracja* [Problems of early school education. Individualization, socialization, integration]. Lublin: UMCS Publishing House, pp. 137–151.

4. Preschool teachers, their working styles and needs

Another important area of my interests is the teacher and teachers' working styles. The style of educational support can be treated as a determinant of effective preschool education. The studies undertaken in this area provided information about the perception of teachers by children, the dominating educational styles in the practice of preschool education, and about the needs for and barriers to professional development of early education teachers

Publications from the area of: Preschool teachers, their working styles and needs

1. Bilewicz-Kuźnia B., Parczewska T. (2009a). *Osoba nauczyciela w percepcji dzieci w wieku przedszkolnym i wczesnoszkolnym* [The teacher perceived by preschool and early years school children]. In: I. Adamek, E. Żmijewska (ed.), *Nauczyciel w systemie edukacyjnym. Teraźniejszość i przyszłość* [Teacher in the education system. Present and future]. Cracow: Pedagogical University Publishing House, pp. 84–97.
2. Bilewicz-Kuźnia B., Parczewska T. (2009b). *The teacher perceived by children with damaged hearing*. W: T. Żółkowska, I. Ramik-Mażewska (eds.), *Special pedagogy in researches and scientific analysis*. Stettin: Publishing House Zapol, pp. 265–273.
3. Bilewicz-Kuźnia B. (2010e). *Stan aktualny, potrzeby i bariery rozwoju zawodowego nauczycieli klas I–III szkół podstawowych* [Current status, needs and the barriers of professional development of primary I-III grades school teachers]. In: S. Guz, I. Zwierzchowska (ed.), *O pomyślny start szkolny dziecka* [For a successful school start of the child] Warsaw: WSP TWP Publishing House, pp. 398–411.
4. Bilewicz-Kuźnia B., Parczewska T. (2010f). *Pedagog specjalny w percepcji wychowanków z upośledzeniem umysłowym* [Special educator in the perception of pupils with mental disability]. In: Z. Palak, A. Bujnowska, A. Pawlak (ed.), *Aktualne problemy edukacji i rehabilitacji osób niepełnosprawnych w biegu życia* [Current problems of education and rehabilitation of disabled people in the course of life]. Lublin: UMCS Publishing House, pp. 88–94.

5. Bilewicz-Kuźnia B. (2011a). *Aktywność fizyczna a stres w zawodzie nauczyciela* [Physical activity and stress in the teaching profession]. In: M. Świdorska (ed.), *Styl życia i zachowania prozdrowotne – wybrane konteksty* [Lifestyle and pro-health behaviors - selected contexts]. Łódź: AHE Publishing House, pp. 319–331.
6. Bilewicz-Kuźnia B. (2012b). *Nauczyciel dziecka w wieku przedszkolnym – osoba i styl jego pracy* [Preschool child's teacher - the person and style of one's work]. In: E. Jakubiak-Zapalska, K. Kruszko (ed.), *Dziecko we wczesnej edukacji* (A child in early education). Radom: Kolegium Nauczycielskie Publishing House, pp. 57–77.

5. Determinants and contexts of preschool education

Exploring preschool pedagogy as a subdiscipline of pedagogy, I took interest in general questions of this area, such as systems of preschool education, curricula and methodological solutions in early childhood education. As a result, a monograph was published which I edited together with Teresa Parczewska [Parczewska, Bilewicz-Kuźnia (red.), 2013]. The publication is a study on the state and essence of contemporary preschool education in the context of cultural transformations in Europe and all over the world. It is divided into three parts: a child in the preschool - between tradition and contemporaneity; European teacher; and methodological and organisational solutions in early childhood education.

My analysis of systems and organisational solutions concerning organising the work with children also resulted in a study concerning the model of preschool education in Ireland, [Bilewicz-Kuźnia, 2015b). The article focuses on selected differences in the curricula and organisation of preschool education in Poland and in Ireland. It discusses the aims, priorities, educational principles, the place and organisation of play in the light of the Polish and Irish core curriculum of preschool education.

Looking for the determinants and conditions of effective preschool education, I also addressed the questions concerning the role of the curriculum of preschool education, observation and the media, that is television. The methodological materials I developed, on the other hand, are an example of combining the theory of preschool pedagogy with practice.

Publications from the area of: Determinants and contexts of preschool education

Monograph:

Parczewska T., Bilewicz-Kuźnia B., ed. (2013). *Edukacja przedszkolna w Polsce i na świecie. Wybrane zagadnienia* [Preschool education in Poland and abroad. Selected questions]. Lublin: UMCS Publishing House, pp. 216.

Articles:

1. Bilewicz-Kuźnia B., Parczewska T. (2010g). *Program jako strategia stymulacji wielokierunkowej aktywności dzieci i nauczyciela* [The program as a strategy for stimulating multi-directional activity of children and teachers]. In: I. Adamek, M. Grochowalska, E. Żmijewska (ed.), *Relacje i konteksty (w) edukacji elementarnej* [Relationships and contexts (in) elementary education]. Cracow: Pedagogical University Publishing House, pp. 120–127.
2. Bilewicz-Kuźnia B., Parczewska T. (2011). *Telewizja lokalna wobec wyrównywania szans edukacyjnych małego dziecka* [Local television to equal educational opportunities for a small child]. In: J. Bałachowicz, Z. Zbróg (ed.), *Edukacja (dla) dziecka – od trzylatka do sześciolatka* [Education (for) a child - from three to six-year-old]. Cracow: Libron Publishing House, pp. 155–166.
3. Bilewicz-Kuźnia B. (2015b). *Wychowanie przedszkolne w świetle prawa i praktyki w Polsce i Irlandii – w poszukiwaniu efektywnych rozwiązań* [Preschool education in Poland and Ireland in the light of law and practice - in search of effective solutions]. In: S. Guz, M. Centner-Guz, I. Zwierchowska (ed.), *W trosce o rozwój i wczesną edukację dziecka* [In the interest of the child's development and early education]. Lublin: UMCS Publishing House, pp. 75–94.
4. Bilewicz-Kuźnia B. (2016b). *Obserwacja rozwoju dziecka zorientowana na zmian* [A process-oriented child monitoring system for young children]. In: K. Kraszewski, I. Paśko (ed.), *Aktywność poznawcza i działaniowa dzieci w badaniach pedagogicznych* [Cognitive and

action activity of children in pedagogical research]. Cracow: Pedagogical University Publishing House, pp. 66–72.

Methodical publications:

1. Bilewicz-Kuźnia B. (2010b). *Metoda projektów, czyli jak wyzwalać aktywność i rozwijać samodzielność u dzieci* [Project method, how to trigger activity and develop independence of children]. *Blżej Przedszkola*, no 12, pp. 16–19.
2. Bilewicz-Kuźnia B., Parczewska T. (2010a). *Kajecik 4-latka. Część 1* [Four-year old notebook. Part1]. Warszawa: Nowa Era Publishing House, pp 43.
3. Bilewicz-Kuźnia B., Parczewska T. (2010b). *Kajecik 4-latka. Część 2* [Four-year old notebook. Part1]. Warsaw: Nowa Era Publishing House, pp. 43.
4. Bilewicz-Kuźnia B., Parczewska T. (2010d). *Ku dziecku. Program wychowania przedszkolnego* [Toward a child. Curriculum]. Warsaw: Nowa Era Publishing House, pp. 83.
5. Bilewicz-Kuźnia B., Parczewska T. (2010e). *Metoda projektów w edukacji małego dziecka. Propozycje metodyczne do programu wychowania przedszkolnego Ku dziecku* [The project method in the education of a small child. Methodological proposals for the pre-school education curriculum Toward a child]. Warsaw: Nowa Era, Publishing House, pp. 116.

In conclusion, I would like to mention that my research activities are closely linked to my presence in the world of practice. The effects of my research are implemented to preschool reality in the form of application of products, e.g. curricula of preschool education, teaching materials or diagnostic tools. According to the results from the Publish or Perish database, the number of cited articles amounts to 20, the number of citations - 27, and h-index = 3. I am an expert in pedagogical innovations implemented all over Poland in preschool institutions; I collaborate with pedagogical publishing houses and the media. The objective of my professional work is not only to build new knowledge, but also to strengthen the relationships between the world of science and the pedagogical practice.

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2. Bilewicz-Kuźnia B. (2008a). *Jak przedszkole może wspomagać rozwój twórczej aktywności – na podstawie doświadczeń brytyjskich* [How a kindergarten can support the development of creative activity - based on British experience]. *Wychowanie na co dzień*, no 1–2, pp. 34–36.
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4. Bilewicz-Kuźnia B. (2008c). *Skuteczność wspomagania rozwoju zdolności twórczych dzieci sześcioletnich poprzez wykorzystanie autorskiego programu eksperymentalnego* [Effectiveness of supporting the development of creative abilities six-year-old's children through using author's experimental program]. In: J. Łaszczuk, M. Jabłonowska (ed.), *Uczeń zdolny wyzwaniem dla współczesnej edukacji* [A gifted student as a challenge of contemporary education]. Warsaw: Akademy of Special Education Publishing House, pp. 294–302.
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 8. Bilewicz-Kuźnia B. (2010a). *Kształtowanie pojęć matematycznych na etapie wczesnej edukacji* [Forming mathematical concepts at the early education stage]. In: T. Parczewska (ed.), *Psychopedagogiczne aspekty rozwoju i edukacji małego dziecka* [Psychopedagogical aspects of the development and education of a small child]. Lublin: UMCS Publishing House, pp. 125–145.
 9. Bilewicz-Kuźnia B. (2010b). *Metoda projektów, czyli jak wyzwalać aktywność i rozwijać samodzielność u dzieci* [Project method, how to trigger activity and develop independence of children]. *Blżej Przedszkola*, no 12, pp. 16–19.
 10. Bilewicz-Kuźnia B. (2010c). *Praca z dzieckiem zdolnym – potrzeba, rzeczywistość, uwarunkowania skuteczności* [Work with a gifted child - need, reality, determinants of effectiveness]. In: *Klíčové kompetence a jejich reflexe v přípravě učitelů primárního vzdělávání. Sborník příspěvků z konference s mezinárodní účastí*. Liberec: Technická Univerzita v Liberci, pp. 25–31.
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