Zbigniew Meger

Summary of professional accomplishments

Spis treści

Summary of professional accomplishments

1. Name and surname

Zbigniew Meger

2. Held diplomas, scientific titles

with provision of the name, place and year of achieving them and the title of the doctoral thesis

Academic degree: *Doctor Paedagogicae* (Doctor of educational sciences).

Specialty: *Didaktik der Physik* (didactics of physics).

Unit: *Humboldt Universität zu Berlin* (Humboldt University of Berlin).

Thesis topic: *Untersuchungen zur Individualisierung durch Nutzung eines integrierten Computerlernsystems/* Studies on individualisation of education by using an integrated computer learning system.

Thesis advisor: Prof. Hansjoachim Lechner PhD (Humboldt Universität zu Berlin)

Reviewers: Prof. Helmut Menschel PhD (Technische Universität Dresden).
Prof. Jörn Bruhn PhD (Universität Hamburg).

Place and date of the defence: Berlin, 14.07.1994

Thesis grade (written in the diploma): *cum laude*. The work took part in the competition for the best doctoral thesis in Germany in 1994, organised by a prestige association *Gesellschaft für Didaktik der Chemie und Physik GDCP* (Association of Education of Chemistry and Physics).

The doctor's degree was granted by a globally renowned University (pos. 54 according to *Presence Rank*), located in an EU membership state (on the basis of international agreements, it does not require a nostrification in Poland).

3. Information about past employment at research units

1986 - 1992	**Assistant Lecturer** at Higher School of Pedagogy in Słupsk (Institute of Physics, Department of Didactics of Physics)
1992 - 1994	**Scholar** of Deutscher Akademischer Austauschdienst DAAD (German Academic Service of Exchange), doctoral student at the Humboldt University of Berlin, manager of *Individualisierung im Physikunterreicht* project (Individualisation of education in Physics)
1994 - 2004	Assistant Professor at Pomeranian University in Słupsk (formerly Higher School of Pedagogy) (Institute of Physics, Department of Didactics of Physics), including:
1994 - 1997	**Manager of a foreign project:** *Programm zur Vergabe von Gerätespenden für ausländische Institutionen*, financed in 100% by Deutscher Akademischer Austauschdienst DAAD, at the name of *Computerlehrlabor für Lehre und Forschung* (Computer laboratory for educational and research aims)
1997 - 2002	**Deputy Dean** for education and extramural studies of the Faculty of Mathematics and Environment of Higher School of Pedagogy in Słupsk
2002 - 2004	**Deputy Dean** for education of the Faculty of Mathematics and Environment of Pomeranian University in Słupsk
2004 - 2005	*Gastdozent: Humboldt Universität Berlin* - scientific internship at the Institute of Physics (Department of Education) of the Humboldt University of Berlin (a DAAD scholar)
2005 (III-IX)	*Gastdozent: Technische Universität Berlin* - scientific internship at the Institute of Physics (Department of Education) of the Technical University of Berlin
2005 - 2006	*Gastdozent: Freie Universität* Berlin - scientific internship at the Institute of Physics (Department of Education) of the Free University of Berlin (a DAAD scholarship)
2006 - 2007	Assistant Professor at the Higher School of IT, Management and Administration in Warsaw
2007 - 2009	Assistant Professor at the University of Humanities and Economics in Łódź
2009 - 2014	Assistant Professor and Dean at the University of Social Sciences in Łódź (since 2012 - Social Higher School of Entrepreneurship and Management)
2014 - 2015	Assistant Professor at the Poznań College of Communications and Management
2015 - 2017	Assistant Professor/ Associate Professor at the Bogdan Jański Higher School

Simultaneously - what is essential in pedagogical educational and research activity - I worked for 9 years in total as a teacher (mainly on employment contract) at Community High School no 1 in Słupsk and remained contacts (mostly in the form of contracts and grants financed from European resources) with other educational and scientific and research institutions in Poland and abroad, in order to realise scientific and research as well as research and development projects in the field of widely understood education (essential details are presented in the further part of this summary and in the list of scientific output).

Apart from scientific activity, I also worked at national and commercial institutions, as well as held important managerial positions in the national administration (these positions are not related with scientific and research development, thus they are not listed in this summary).

4. Indication of scientific achievements

resulting from Art. 16 Par. 2 of the Act of 14.03.2003 on Academic Degrees and Title and Degrees in the Arts (Journal of Laws 2016 item 882 as amended in Journal of Laws 2016 item 1311.)

4.1. Title of the scientific achievement

Strategy of collaborative education

4.2. Author and publication title, year of publishing, name of publishers, publishing reviewers

The following monograph is specified as the basis of the postdoctoral achievement:

1) Zbigniew Meger, 2017, Strategia edukacji kooperatywnej z przykładami realizacji/ Strategy of collaborative education with examples of realisation, Wydawnictwo Naukowe PWN, Warsaw 2017, ISBN978-83-01-18636-4
   Reviewers: Prof. zw. dr hab. Wiesław Babik (represented branch: information ecology), Prof. zw. dr hab. Kazimierz Wenta (represented branch: didactics).

This work is developed on the grounds of a previous monograph titled *Kooperatywna edukacja zdalna w kształceniu przyrodniczym/ Collaborative distant education in teaching and learning of natural science* (Meger, 2013), which presents the results of a query on foreign references obtained from libraries of several universities from the Western Europe as well as results of my own scientific research. Both works concern and deeply analyse the issues of CSCL collaborative learning, which, before my communication in this field (Meger, Kooperatywne uczenie się w warunkach e-learningu/ Cooperative learning in e-learning conditions, 2005; Meger, Oddziaływania socjalne w czasie pracy w systemie CSCL/ Social impacts during work in the CSCL system, 2006) were not discussed in Poland, at least in reference to e-learning and education supported by advanced technological means. While the first monograph (Meger, Kooperatywna edukacja zdalna w kształceniu przyrodniczym, 2013) presents fundaments of the CSCL technology (*Computer Supported Collaborative Learning*), and a didactic model developed on its basis, acknowledged in a series of studies, the second work (Meger, 2017) - being a postdoctoral achievement - attempts to generalise this model and adapt it to educational needs. It presents also complementary studies, acknowledging the proposed model of collaborative education. Everything is strongly set in the environment of computer technologies and social services, eagerly used by the modern generation of the network (*digital native*), also for educational aims.

4.3. Discussion of the scientific aim of the above mentioned works and achieved results, along with an analysis of their potential use

Scientific issues of the demonstrated postdoctoral monograph were being shaped for numerous years and their roots lay in early IT technologies, approximately from the period when PLATO

and PLATO2 programs were realised in the United States. Information about these programs, that for the first time in the history attempted to use computers (mainframe type) in didactics for a large scale, were published in Poland in *Młody Technik* (Young technician) magazine in 1970s.

4.3.1. Development of scientific problem

Since my early years, the main aim of my investigations was the following question:

1. ***How can computer technologies change didactic processes?***

I became interested in this problem already as a several-year boy, not only due to reading articles in *Młody Technik*, but mainly participating in IT classes, which were facultative at that time. In high school (High School no 1 in Słupsk), we were offered to write a program in Cobol language for solving quadratic equations, what, today is a trivial task, but at that time, it was related with numerous essential technical problems, not only in the field of programming.

I was very engaged in that task, spending numerous hours in libraries, pulling an all-nighter and spending my whole free time for that. I was very proud when my first program was launched on a large IBM computer, *mainframe* type (there were no micro-computers). I still remember bases of Cobol language, despite I never used it again later (I know ten-odd other programming languages or techniques). Many times later I was wondering where originated my energy for intensive learning a new field of knowledge, in particular:

2. ***In what way can classes with the use of modern technologies have an influence on the activity and efficiency in the process of acquiring knowledge?***

This problem set in such way at that time (although later formulated) became also, apart from the issue of the role of computer technologies in education, an object of my multi-year scientific investigations, within the scope of which, detailed scientific aims and problems were later formulated. We can assume that the first of the above questions became an object of my investigations before becoming a doctor, while the second one - after.

Although both questions, formulated from the perspective of a student, did not show the way of activity, in the course of research proceedings, I was discovering the essence of the psychological and pedagogical motif. Thus, aims in the scope of the first problem - before doctoral studies - focused on determining the didactic importance of rapidly developing IT technology. Solution of the second problem - after becoming a PhD - had to relate to setting a series of detailed aims in the field of psychology and pedagogy, which, after concluding further pedagogic studies, were to lead to generalising theoretical models. These models indicated shortages, thus, there appeared the necessity of new pedagogic research, which, in turn, led to further improved models.

4.3.2. Studies in the field of individualisation of education using microcomputers - achievements before doctor's degree

At the end of my studies at the University of Gdansk, I bought my first microcomputer - ZX-81 (81 denotes the year of production). Of course, I tried to write first educational programs, but due to a limited memory size - 1 kB - it was very difficult (modern computers, or even smartphones have memories million times larger). At a short period of working at the Department of Electronic Computational Technique, where I was able to learn computer technology of that time (*mainframe* and mini-computers, but not yet microcomputers), I started to work as an assistant staff at the Department of Didactics of Physics of the Higher School of Pedagogy in Słupsk.

Due to my computer skills, I was originally engaged into a scientific project in the field of spectroscopy physics, at the time when I was preoccupied with connecting the school's first microcomputer with a post for analysing polarised spectroscope spectra. For this aim, I prepared a set for analysing polarisation with Pockels cell, which, due to being controlled by a computer, can probably still today be an interesting and worth publishing solutions, unique in the global scale, however, a lack of proper magazines at that time, that achievement was not reported.

Originally, my works in the field of supporting physical experiments were not much related with didactics, however, acquiring the skill of connecting a computer with research devices using interfaces had a great importance in constructing later devices for supporting environmental education. In particular, it enabled an active participation in processes of constructing didactic Interactive Screen Experiments (ISE) at the time of work in the Department of Didactics of the Institute of Physics at the Technical University of Berlin (Technische Universität Berlin, Institut für Physik, Abteilung Didaktik).

Learning rules of cooperation (through interfaces) between a computer and technical devices for physical experiments formed bases of the first concepts of using micro-computers in educational processes, thus, to answer the formulated question how computers can change didactic processes. Computer supported physical experiments were also an element of proceedings in pedagogical studies that I presented in my doctoral thesis (Meger, Untersuchungen zur Individualisierung des Physikunterrichts durch Nutzung eines integrierten Computerlernsystems/ Studies on the individualization of physics education by using an integrated computer learning system, 1994).

Searching for a potential of the influence of computer technologies on didactic processes, especially in the environmental education, led to an analysis of possibilities of programming languages, which could simulate physical processes. Visits of Prof. Horst Harreis and Prof. Norbert Treitz from the University of Duisburg-Essen were of significant importance as they instilled in me the idea of education in the field of physics using programming languages. In that way, many of my short programs for solving particular physical problems were developed.

Not widely known in Poland Comal language (promoted by Prof. Treitz) was very suitable for that, but I also studied usability of other languages as well, what I presented in my first article in the *Fizyka w szkole/ Physics at School* magazine (Meger, Lekcja fizyki, a język programowania/ Physics classes and programming language, 1990). A solution of a more advanced problem of black body radiation and its didactic presentation were published in *Postępy Fizyki/ Progressions of Physics* magazine (Wrembel and Meger, 1992).

However, the use of programming languages as a cognitive technology did not prove to be efficient in the course of time. The necessity to learn the complexity of languages, especially their modern versions, is often a barrier almost making learning impossible. Discussion over this subject was conducted in Poland and in the World for many years (approximately till the end of the 20th century) but currently, this topic is brought up by not many people.

Further search in the field of efficient ways of using computers in education was related with studies on possibilities of using computer games. Nowadays, this issue is developing rapidly (especially post 2005), mainly in the field of network educational games, and even got its Polish term - "grywalizacja" (gamification). However, not many pioneers in this branch were interested in this subject before the launch of the first website (1990/1991). My attempts led to development of several educational games, e.g. multi-level graphical game titled „Journey to the core" (of atom), however, it was not popularised due to incomplete compatibility of hardware. I discussed possibilities related with video games during the conference *Problemy Dydaktyki Fizyki/ Problems of Didactics of Physics* (Meger, Komputerowe gry dydaktyczne w nauczaniu fizyki/ Didactic computer games in physics learning, 1990). Studies related with implementation of games in cognitive processes were presented in my article titled *Efficiency of educational computer games* (Meger, Skuteczność edukacyjnych gier komputerowych, 1994).

My search for new possibilities of using computer technologies in didactics were more focused on providing a proper pedagogic environment. What we today call an educational platform did not exist earlier, but technological options, especially those network related, created greater chances for new computer systems dedicated to education. As my previous achievements in the field of IT related with a good knowledge of database management systems (I wrote 3 books in this subject), at the end of 1980s, I attempted to develop a universal system for teaching and learning physics. That educational platform, initially functioning only in a local network, was launched in 1991 at Community High School no 1 in Słupsk and was used for conducting pedagogic studies for several years.

The main aim of studies was to check if computers have an influence on improving the efficiency of learning. In this context, an essential issue was individualisation of learning, which, through a personalised access for each student could be realised in a new system. In that way, there appeared another essential scientific problem, i.e. in what way computers can help in the individualisation of teaching and learning physics.

Apart from the main problem of using computers in educational processes, these questions became the basis for considerations in my PhD thesis, defended at the Humboldt University.

The studies showed that computers can be helpful in educational processes. They can also support individualisation of education in the field of physics, as well as an individualisation of physical experiments, what was a novelty of that time.

Preparation of my PhD thesis required much work, breaking stereotypes about Polish science, but it provided me with bases of modern scientific thinking and discussion. In such discussion, it is an often case when presented concepts are criticised (essentially) but no one is offended due to this but this is an incentive for further development and activity. I had a chance to know how far we are from this model of this discussion which is creative and greatly supportive for development of science.

4.3.3. Studies in the scope of collaborative education in conditions of using advanced IT technologies - achievements past PhD

Obtaining the title of PhD at the Humboldt University was not the end of my studies in the field of possibilities of IT technologies and efficient ways of acquiring knowledge. Quite the contrary, numerous discussions with educators, and most of all, knowing substantial amount of references, provided me with fundaments for formulating new essential scientific aims. German scientists were forerunners of pedagogy and psychology of media, have broad empirical experience and really rich scientific literature. Thus, it is not a surprise that the number of works concerning this subject in German libraries is many times higher than in Poland (it may be true that it is higher by even a three-digit number). This is why that in my PhD thesis as well as in further works, I more eagerly quote most modern approaches from foreign literature. In any case, I do not want to depreciate Polish pedagogy, which in many fields is developing very dynamically. I continued my research at German libraries for many years, including my 2-year internship in the years 2004 - 2005 as well as in recent years, during private few-day trips.

Analysis of literature, consultations with colleagues from Germany, as well as conclusions from conducted studies (before and just after PhD) allowed me to have a new view on didactic experiments. Observations mainly concerned large amount of data, e.g. many thousands of computer measurements in the scope of ways of proceeding of learning people. A statistical analysis (conducted using SPSS package, Quattro and later Excel worksheets) did not allow drawing reasonable conclusions (apart from the fact of significant discrepancy of data). Having low amount of data (e.g. in comparisons of results of test of achievements of a study group and a reference group), statistical analysis revealed low reliability. It turns out that at very large samples of analysed students (e.g. in PISA studies) there are problems with reliability of data, thus analyses of such type are often discounted. Thus, I conducted my further pedagogic studies mostly in the qualitative aspect, although quantitative analyses were not completely overlooked. An approach of such type, sometimes called *action research*, is currently presented in many serious pedagogic researches.

Considering qualitative criteria, I again analysed data obtained in studies before PhD and in conditions of a modernised platform soon after PhD. It turned out that conclusions about better results of persons learning individually were not complete. Similar good results were obtained also by people working in two-member teams. What is more, such persons usually worked faster. I included these observations in my book, which generally concerns results described in not published PhD thesis, however presenting also new observations and data (Meger, Individualization in physics teaching with help of computers/ Individualisierung im Physikunterricht mit Hilfe der Computer, 1995). New observations concerned also time of learning using computer by different people, what I presented at the conference in Kielce titled „Computer in education" (Meger, Problemy indywidualizacji kształcenia a nauczanie wspomagane komputerem (wnioski z badań dydaktycznych w nauczaniu fizyki)/ Problems of individualisation of education and computer assisted teaching (conclusions from didactic studies in teaching physics), 1995). I discussed attitudes of students working with an integrated computer system at a conference in Hamburg (Meger, Student attitudes by working with integrated learning systems/ Einstellungen der Schüler bei der Arbeit mit integrierten Lernsystemen, 1994), and a lecture about the specificity of natural sciences in educational systems, considering my most modern studies, was presented by me during a conference in Duisburg (Meger, Results of the computer-assisted learning of astronomy and gravitation/ Ergebnisse des computerunterstützten Unterrichts der Astronomie und Gravitation, 1995). Discussions during conferences, as well as those among experts, not necessarily led to the conclusion that individualised learning must be better than in groups. Thus, I decided to comprehensively analyse the problem whether group education supported by technological means can lead to better results.

I started that research from browsing literature, an access to which - due to above mentioned circumstances - had to be planned and properly arranged. From the technical side, in order to build a base of literature, I used MS Access management system, and for the web publishing, I used MySQL system with a transformation to XML format and Internet management using PHP language. I published the whole database on my private website on the university's server (in hu-berlin.de domain) during my internship at the Humboldt University in the years 2004 - 2005. Unfortunately, due to restrictions of copyright laws in Germany (as well as in Poland), not all data could be published in an open network, thus they had to be divided into data available in local and public networks. I informed about problems related with building such database and its structure during a conference in Berlin (Meger, Problems of multimedia physics learning - building a database/ Probleme des multimedialen Physikunterrichts - Aufbau einer Datenbank, 2005). For the current state (03.03.2018) the database includes 7969 records, with individual substantive descriptions. Each description includes from one sentence to even several pages, and can include numerous attachments. The total size of the database is 25.8 GB in 71058 files (work on each file usually took from few to ten-odd minutes). The whole work was conducted solely by me.

It is worth to mention that 20% of scientific works classified in the database concerns publications in Poland or works developed by Polish scientists. The international name of the database is: LiDa (EN: *Literature Database*, GER: *Literatur Datenbank*, POL: *Literatura-Dane*). Originally, it was meant to concern only issues of education in the field of physics, what allowed setting trends in this scope, about which I informed during the conference *Multimedia in Physics Teaching and Learning* (Meger, Trends in Multimedia Physics Education. Review of Literature Database, 2005). However, broadening its scope enabled setting trends also in e-learning, about what I run a lecture during *International conference on e-learning in education* (Meger, E-learning - European Trends, 2006). Currently, its scope includes 16 main branches of network education assisted by computers or other technological means, among which, 176 detailed areas were distinguished - from bases with psychological fundaments to the most modern works, which are difficult to be classified so far. The character of the database is dynamic, it is constantly modified and expanded.

Studies in the literature supported with database mechanisms for fast access to interesting content enabled determining detailed problems in the scope of the chief trend of my research interests. During a lecture in Heidelberg, I discussed new essential scientific problems appearing in the field of education of physics (Meger, Offene Fragen des multimedialen Physikunterrichts auf Grund der Erstellung einer Datenbank/ Open questions of multimedia physics education due to the creation of a database, 2005). However, a series of essential problems, including issues related with collaborative education, appear in the literature, mainly in the field of network education, which is developing since the beginnings of the 21st century (Meger, Analysis of E-learning Literature through Use of Authors System of LiDa Database, 2005). Early noticing the trend of collaborative learning in respect to e-learning would not be possible without a profound analysis of literature with a support of selection mechanisms in the LiDa system, about what I informed during a conference in Gdynia (Meger, Analysis of literature on e-learning in a database management system, 2005). Scientific reports in the field of collaborative education were in line with my research experiences in the scope of results of teaching in small groups, thus there appeared my special interest in collaborative technologies in the area of education supported with modern technological means.

At the beginning of previous decade, collaborative education technologies, especially CSCL (*Computer Supported Collaborative Learning*), were completely unknown in Poland or I did not find any reports in this field in Polish works. Thus, I presented new possibilities of collaborative education during a conference devoted to e-learning in Warsaw (Meger, Oddziaływania socjalne w czasie pracy w systemie CSCL/ Social impacts in working in CSCL system, 2005). I discussed this issue in the context of trends in education in the article titled *Podstawy e-learningu. Od Shannona do konstruktywizmu/ Bases of e-learning. From Shannon to constructivism*, published in *E-mentor* magazine (Meger, 2006). In this article, I assume, what is surely a new approach in the global scale, that an approach to educational theories can originate in the genial theory by Cloud Shannon, an American mathematician, who predicted the most optimal code (binary) for the development of computers. According to me,

this theory is useful in understanding trends in education, also in the context of collaborative education. This completely original approach was widely quoted.

Although I formulated the essence of collaborative education in the first half of 2000s, I attempted studies in the field of collaboration in learning earlier, including research on person working in pairs. Further studies, being a search in the area of group collaboration with computer support, were based on a known method of projects. I spoke about new studies in this field, related with students' physical experiments with computer assistance, during a conference in Bremen (Meger, Computerunterstützte Projekte im Physikunterricht/ Computer supported projects in physics education, 1997), and about further achievements in Potsdam (Meger, Projects of computer-assisted experimentation/ Projekte des Computerunterstützten Experimentierens, 1998). An interesting conference discussion, also behind the scenes, was evoked by a proposal of experiments combining education in physics with physical education (Meger, Correlation of physics and sport learning in multimedia environment, 2004). At the first conference in Bonn, *European Physics Education Conference EPEC*, I presented pioneer studies in the field of efficiency of remote education of physics (Meger, Experiences in physics-e-learning in Poland, 2005). From that publication, further studies presented the aspect of education mainly in the context of e-learning, including collaborative education. I presented numerous studies undertaking various pedagogic aspects of collaborative education in my work titled *Kooperatywna edukacja zdalna w kształceniu przyrodniczym/ Collaborative e-learning in natural education* (Meger, 2013). The studies in general acknowledge a high efficiency of collaborative learning and at the same time reveal a great engagement of learners.

As special attention should be paid on studies in ISE (EN *Interactive Screen Experiments - ISE*, GER *Interaktive Bildschirm Expermiente - IBE, PL Interaktywne Eksperymenty Ekranowe - IEE*). This technology was not earlier known in Poland, while quite well developed in Germany. For at least one year I was proud to work in a team preparing such experiments at the Department of Physics in Berlin (originally Technische-Universität Berlin, next, after moving - Freie Universität Berlin). Information in this subject scope, evoking lively discussions, I presented during a conference in Koszalin. (Meger, E-learning: high tech, czy high teach? Interaktywne eksperymenty ekranowe/ E-learning: high tech or high teach? Interactive screen experiments, 2006), and in an extended version during a conference *E-learning akademicki - nowe oblicza procesu kształcenia w szkolnictwie wyższym/ Academic E-learning - new images of the process of teaching in higher education* (Meger, Nowe technologie w europejskim e-learningu/ New technologies in European e-learning, 2007). I presented selected interactive screen experiments and examples of their use during 7th Virtual University Conference VU'2007 at the Warsaw University (Meger, Virtual laboratories in collaborative learning nature, 2007). At the next VU'2008, I presented possibilities of combining interactive screen experiments with *storytelling* technique (Meger, 3D storytelling in a virtual laboratory, 2008). It must be mentioned that *storytelling* technique is more widely used in collaborative education.

In the context of the main area of research interests, my own expansion is collaborative screen experiments. I presented information in this scope during *5th International Conference on Technology in Teaching and Learning in Higher Education* (Meger, Interactive Screen Experiments in Collaborative Environment, 2007). Another proposal of mine, probably not previously discussed in global literature, were experiments in 3D, using the technology of interactive (2D) screen experiments, also in collaborative version. I presented possibilities of transferring a platform of collaborative screen experiments to 3D (of course, in the form of a 3D presentation) during *EDUVATE 2008 - Education Innovation Quest: A Century in the Service of Knowledge*, which took place in Pretoria, South Africa (Meger, 6th generation of distance learning, 2008). The issue of collaborative screen experiments was intensively discussed during those two conferences, including questions about technological solutions, possibilities of adaptation to existing educational platforms. I have reports that this issue was later discussed by the National Louis University, USA, but it was finally not accepted. A full realisation of interactive screen experiments in 3D (e.g. a virtual building of a school or university) is possible but requires substantial resources. Although having an international interest, chances for obtaining sufficient support for realisation of such serious enterprise were not realistic from the perspective of a small university (that I represented at that time). Nevertheless, it was possible to gather an international consortium for the project realisation, interest in which presented e.g. Prof. Thomsen, current rector of Technische Universität Berlin. Other entities that showed an interest in participation in the project included the University of Munich, the University of Botswana, and the University of Sousse in Tunisia, where I run discussions in person. 3D experiment could replace standard experiments at those schools that did not have proper experimental equipment, what concerns not only thousands of Polish schools of different level, but also numerous schools in Africa and developing countries. This concept has not been realised till present day.

A large number of studies in the field of didactic experiment, as well as experiences in the area of physical experiments, resulted in the necessity of summarising achievements at the experimental level and transferring results into a model form. My first attempt of such type concerned education of physics and it was presented during an international conference: *11th Symposium of International Organization for Science and Technology Education* in Lublin (Meger, Model of individual multimedia physics learning, 2004). As that model was limited only to situations of individualised learning, it was necessary to broaden it to other didactic situations in education supported by technological means, what I presented during a conference in Heidelberg (Meger, Modell des multimedialen Physikunterrichts in Polen/ Model of multimedia physics education in Polan, 2005). I presented conditions of this model also during colloquia organised at the Humboldt University and the Technical University of Berlin. Discussion on the content of this model revealed its weakness as far as affective factors are concerned. In fact, the role of these factors in didactics was perceived only at the end of 2000s, what was related with noticing some imperfectness of constructive didactics.

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Thus, I undertook studies in the field of the role of affective factors in education. I described analysis of literature in this scope and my own didactic observations in three articles published in consecutive issues of *E-mentor* magazine, that concerned emotions (Meger, (Meger, Czynniki afektywne w zdalnej edukacji/ Affective factors in distant learning, 2008), motivation (Meger, Motywacja w nauczaniu zdalnym/ Motivation in distant learning, 2008), and will (Meger, Strategie motywacyjno-wolitywne w edukacji zdalnej/ Motivational and volitional strategies in distant learning, 2008) in educational processes. Affective impact using images was presented in my monograph published by the University of Gdansk (Meger, Oddziaływać afektywnie, czyli uwagi o wykorzystaniu obrazu w nauczaniu/ Affective influence, i.e. notes about using images in education, 2009). All these works formed a basis for developing a model of collaborative education, which initially concerned natural sciences (Meger, Kooperatywna edukacja zdalna w kształceniu przyrodniczym/ Collaborative distant education in teaching and learning of natural science, 2013), while a generalised strategy of collaborative education was created later (Meger, Strategy of collaborative education with examples of realisation, 2017).

4.3.4. Strategy of collaborative education and conclusions from studies

Studies on literature, studies at schools of various levels, studies in the scope of developing a modern model of natural experiment, as well first studies and replies in the field of a model of physical education supported with technological means provided the basis for preparation of generalised considerations in respect to collaborative education in natural sciences.

Although, group education itself, underlying collaborative education, is not a new phenomenon, but it gets a new importance in the face of using modern means of communication, as well as new trends in cognitive psychology. Psychological basics, especially constructivistic approach, were the base for considerations in the scope of collaborative strategy. Although new trends are already common, in the educational space, there appear more and more publications and educational applications, which refer to previously criticised behaviourism in a convenient way (with computer assistance). We could even observe a specific trend of neo-behaviourism, thus I discuss it in the article published in *Kwartalnik Pedagogiczny* (Pedagogic Quarterly magazine) (Meger, *Neobehawioryzm współczesnego oprogramowania edukacyjnego*/ Neo-behaviourism of modern educational software, 2012). In the context of collaborative education, I also present my own respect to cognitivism (Meger, Kognitywne dążenia w multimedialnych programach edukacyjnych/ Cognitive tendencies in multimedia educational software, 2009) and connectivism (Meger, Od behawioryzmu do konektywizmu współczesnego e-learningu/ From behaviourism to connectivism of modern e-learning, 2012). Only after explaining these theoretical and pedagogic issues, in the work titled *Collaborative Process in Science Education* (Meger, 2012), I presented the first theoretical concept of the collaborative process of education in view of various theories of education, which became the basis for a more complex conceptualisation of this subject.

Considering conclusions from the above mentioned works, as well as conclusions from conducted studies, I developed a completely new approach concerning collaborative education, so far not presented in global literature. In the book *Kooperatywna edukacja zdalna w kształceniu przyrodniczym*/ Collaborative distant education in teaching and learning of natural science (Meger, 2013), in 272 pages, I briefly present a new model of collaborative education in teaching natural sciences. In the first chapter, *Basics of CSCL: scientific theories, model, studies*, I discuss fundamental concepts of distant education, including the constructivistic approach and the theory of connectivism. In chapter two, *Collaborative processes in natural education*, on the basis of the known model 3C (Communication - Coordination - Cooperation), I build a new model 4C (+ Construction), what is to stress the importance of construction in respect to modern concepts of representation of knowledge and constructivistic ideas of educational processes. The culmination of the second chapter is an original model of the collaborative process of education, designed especially for natural education.

Chapter three titled *Preparation of environment for collaborative education* presents an essential aspect of combining didactic fundaments with an IT structure of CVE (*Collaborative Virtual Environment*). The chapter presents a new proposal of a layered CVE model, which includes a component of experiment, especially important in natural sciences. The fourth chapter - *Realisation of collaborative natural education* - includes previously not published studies of the author in the field of collaborative education that concerned e.g. the use of concept mapping, virtual 3D spaces for learning, and didactic games. It speaks also about portals and social services, although services of such type are observed in the context of educational implementations only in recent years.

The issue of social networks and their capabilities became very important in pedagogic circles. Thus, about a change of educational perspective due to increasing dissemination of social networks and services I wrote in *Edu@kcja* magazine (Meger, Zmiany w e-edukacji z perspektywy społecznej/ Changes in e-learning from the social perspective, 2011), and about new educational tools and practical implementations, I wrote in the monograph titled *E-learning - narzędzia i praktyka/ E-learning - tools and practice* (Meger, Nowe narzędzia w sieciach społecznościowych/ New tools in social networks, 2012). The presence of social networks and services in educational processes was fully considered in my newest monograph titled *Strategia edukacji kooperatywnej/ Strategy of collaborative education* (Meger, 2017), which I regard as the basis of my postdoctoral achievement.

A new monograph (Meger, Strategia edukacji kooperatywnej z przykładami realizacji/ Strategy of collaborative education with examples of realisation, 2017) is an expansion of the first monograph concerning collaborative education (Meger, Kooperatywna edukacja zdalna w kształceniu przyrodniczym/ Collaborative distant education in teaching and learning of natural science, 2013). The previously presented concept, basing on the proposed two-dimensional 4C model (Communication - Coordination - Construction - Cooperation), in the new monograph,

was developed to a model of a 3D cube, which is to depict various levels of education and occurring there cognitive and metacognitive impacts. Thus, there occurred a clear differentiation of educational activities, including collaborative activities at various levels of education. The cube model also depicts various phases of educational processes and their types, what has a practical importance in explaining distinction on the new educational strategy.

The monograph focuses mainly on naming and precise defining three chief educational strategies: 1) strategy of teaching, 2) strategy of learning 3), strategy of collaboration, which are based on three main trends of cognitive psychology: 1) behaviourism, 2) cognitivism, and 3) constructivism. These strategies and there location in the cube model are presented in the first chapter titled *Didactic strategies*.

Chapter two presents *Cognitive and metacognitive conditions of collaboration*. After explaining terminological issues, I stress the importance of metacognitive activities in collaborative education, which provide a proper work environment for teachers and learners. In this context, cognitive and metacognitive aims of education are of a special importance, as well as usually different in their aspirations aims of teaching and learning. The proposed concept of aims of education is a completely original and unique approach of the monograph, and a proper formulation of them has an essential importance in the strategy of collaboration.

Chapter three - *Affective dimension of collaboration* - concerns these metacognitive conditions, which are related with emotions, motivation, and will of acting. After defining essential terms in the scope of affective impacts, the author presents the importance of particular emotive components in different strategies of education. A special value of the chapter is determining the use of which emotions and in which phases enables impacts in various phases of the didactic process. The location of cognitive and metacognitive (including affective ones) factors, having an influence on didactic processes in various strategies of education was explained using the cube model. Thanks to such conceptualisation, the chapter is probably the world's first, so efficiently organised, synthetic approach to numerous affective factors, which are essential in collaborative education.

In chapter four, on the basis of presented conditions, I proposed a new structure of collaborative didactic process, and instead of most commonly presented three didactic phases, I propose four phases, including introductive and decisive phases, previously completely omitted, however being very important from the perspective of metacognitive impacts. Chapter titled *Cognitive and volitional collaborative strategy* presents previously not published, complete model of proceeding in the collaborative strategy with its numerous conditions and capabilities. It seems the most complex approach to model presentation of the collaborative process with numerous practical indications.

Two last chapters, *Strategy of collaboration in school education* and *Collaboration in didactic processes in higher education schools*, present mostly completely new studies in the field of collaborative education, conducted at primary, junior-high, secondary levels of education, as

well as at the level of higher education. It is noteworthy that in all cases where quantitative studies are presented, results of work in the analysed groups were better than results of the reference group. What is more, observations indicate a high level of satisfaction and activity of persons participating in the collaborative cognitive process.

In the whole work, the author much cared to maintain clarity of views and simplicity of language, however, not loosing the briefness of scientific utterance. The strategy of collaborative education, presented in numerous stages through the cube model, is a completely innovative work, not previously published, which I perceive as my personal contribution in the world's pedagogy. Collaborative concepts are more and more eagerly presented in global publications. In Poland, there still predominate views about the necessity of individualising education (also in large educational programs), thus, it is not easy to be heard with new concepts. However, constructivistic psychology and resulting collaborative concepts are getting still more enthusiasts.

5. Other scientific and research achievements

My scientific output includes 109 publications. They include: 7 books and monographs, 2 co-editing monographs, 1 co-edition of a magazine from list B, 30 chapters in monographs, 28 articles in magazines (14 in magazines from list B and 1 in magazine from list C). Among them, 52 works present original, previously not published studies.

What is more, 32 works (including 2 monographs) were written in a foreign language (English or German), 18 of them were published abroad. I am also an author of translation of 1 book from English to Polish and 1 book from Polish to German.

The total number of points of the Ministry of Science and Higher Education for publications is 385. The number of points was determined in accordance to the *Regulation of the Minister of Science and Higher Education of 12.12.2016 on granting scientific categories to scientific entities and schools, in which basic organisational units are not distinguished in accordance to their statutes*. **The number of points of the Ministry of Science and Higher Education after PhD, calculated in accordance to the above mentioned regulation and the year granting - is 281.**

My works were quoted 116 times (the full list is presented in the attachment to *List of published scientific works)*. **H-index calculated for my publications is H=6.**

According to the *Publish or Perish* system and *Google Scholar* database, the number of quotations of my works (after separating invalid references) for the phrase „Z. eger" is: 93, and for the phrase „Zbigniew Meger - SAN": 73. **H-index in both cases is H=5.**

Apart from published works, my academic achievement includes further 22 works, which are being prepared for printing, during editorial process, or developed by order of other

institutions. They include 220 standard pages (1800 characters) and 70 pictures. The whole published output exceeds 3000 standard pages, 220 pictures and over 100 tables, most usually presenting my further studies or analyses. During scientific conferences (in Poland and abroad) or during other seminars or meetings (being invited by organisers), I presented over 100 scientific lectures, always illustrated with PowerPoint slideshows (with pictures and tables).

My other scientific achievements, not mentioned in point 4., include mainly works related with IT. In my opinion, these works had and still have a significant influence on own achievements in the field of pedagogy. This concerns mostly works before PhD and 3 published monographs concerning systems of databases. These monographs were published by not widely known publishers, but, due to response time and time for preparing a complete work for printing, in small but rapidly developing private companies (in case of publishing companies, which were national at that time, this could take even several years). As these books were published in small print runs of several hundreds of copies, it is possible that I am a forerunner of some terms in Polish language, which, according to my knowledge, were not previously in Polish works (this concerns also terms in the field of collaborative education). The scope of my interests expressed in these first works (systems for database management) was later used e.g. in the above mentioned programs or didactic system, including in one of the first approaches to network didactic systems, which was a prototype of an educational platform. Database systems were used also for developing a network database of literature - LiDa - including data and own descriptions of publications concerning e-learning and education assisted with technological means. Apart from pedagogic implementations, I can mention the use of knowledge about databases in an application simulating stock market trends, which, using elements of artificial intelligence, stored information of a variable structure of a neural network in database systems.

A 30-pages not published work concerning *Comal* programming language can be an important position of my pedagogic achievements. As I could observe after several years, thanks to copies made on simple duplicating machines, the work was disseminated not only among IT specialists interested in this language, but also educators, mainly of physics, who wanted to present educational content in that way. In comparison to Logo language that was promoted at that time, Comal had numerous advantages. However, it could not be widely used due to a lack of compatibility of translators of this language with the equipment that was most commonly used at schools. Although, finally Comal did not catch on, I was surely one of pioneers of another approach to using programming languages for educational aims.

Another important scientific achievement was pointing to technological issues of construction of educational platforms, which significantly influence the shape of a didactic process. This relationship of structures of platform modules with didactic proceeding, in my opinion, very essential from the pedagogic perspective, was disregarded by IT specialists who did not have pedagogic knowledge, as well as educators, who were most often not acquainted with IT details and constructions of educational platforms. Metadata used for description of data and

activities realised through educational platforms have a key importance in designing didactic processes. I discuss this issue in the article titled *Analiza metadanych, jako kryterium jakościowe w e-learningu/ Analysis of metadata as a qualitative criterion in e-learning* (Meger, 2012). The structure of metadata determines the standard of a platform, which is responsible for the compatibility of various solutions (Meger, Użyteczność standardów w zakresie e-learningu/ Usability of standards in e-learning, 2011). A special role in various platforms is played by SCORM standard, about which I informed during the conference titled *Wirtualny Uniwersytet: model, narzędzia, praktyka/ Virtual University: model, tools, practice* (Meger, Standardy e-learningu/ Standards of e-learning, 2010). It enable even using elements of artificial intelligence in developing didactic processes, what can not be provided by other solutions. The standard used in an educational platform is an essential factor decisive in platform selection process, as dominating or in operation in a school or university, about which I inform in my monograph titled *Postępy e-edukacji/ Progress of e-learning* (Meger, Problemy wyboru platformy nauczania-uczenia się/ Problems of selection of a platform for teaching and learning, 2010). In order to present good solutions in the scope of selecting a platform, I analysed ten-odd popular commercial and *open-source* platforms and determined the selection criteria. The article and widely and long discussed lecture related with this issues (Meger, Platformy nauczania i uczenia się w Europie i na świecie/ Platforms for teaching and learning in Europe and World, 2009) proved to be helpful in selection of an educational platform at several schools of higher education.

The type of selected platform can have a significant influence on the school's or university's educational policy. I was discussing this issue during a conference at the Warsaw University of Technology (Meger, E-learning, uczelnia i polityka/ E-learning, university and politics, 2008), and informed about the importance of alliances of schools, especially those using the same platform, as well as examples from other countries in the monograph titled *Postępy e-learningu/ Progress of e-learning* (Meger, E-Learning a polityka/ E-Learning and politics, 2008). A very wide vision is presented in my article: *Wirtualny uniwersytet - utopia, czy rzeczywistość/ Virtual university - Utopia or reality* (Meger, 2007). It is worth to mention that about the necessity of consolidation of efforts in the scope of constructing common platforms and digital resources I already mentioned during a conference that took place in 2005 (Meger, Konsolidacja platform e-learningowych w ujęciu europejskim/ Consolidation of e-learning platforms in the European perspective, 2005), however, activities in this field were efficient only in few cases, and there is a space for further achievements in this area.

Standard commonly used educational platforms do not have a module for natural experiments (although more expansions enable solutions of such type). In the context of my main scientific research, I perceived this aspect as a barrier for development of natural education realised by the means of educational platforms. In order to overcome such obstacle, I made attempts in the scope of proposing new physical experiments, as well as including such modules in existing platform structures. An example of the first solution can be a computer assisted system for measuring thermal conduction, which I constructed for the needs of the 1st Physical Workroom

of the contemporary Higher School of Pedagogy in Słupsk. Presentation of the system during the conference in Hamburg organised by *Deutsche Physikalische Gesellschaft* (Meger, Messung der Wärmeleitung mit Hilfe des Computers/ Measurement of heat conduction with help of computer, 1994) was widely discussed and faced a large interest. It turned out that the proposed system, efficiently supported by temperature sensors, connected with an analog-to-digital converter of a computer, is unique in the European scale, although being constructed only to educational aims.

Deficiencies of platforms in the scope of efficient ways of supporting natural experiments were many times analysed in my works. An obvious solution was my first attempts in the field of constructing an educational platform, which offered working with experimental modules as standard not an option. Further solutions did not have such comfortable characteristics. My proposals in new systems concerned mainly the use of modules of collaborative screen experiments (Meger, E-learning: high tech, czy high teach? Interaktywne eksperymenty ekranowe/ E-learning: high tech or high teach? Interactive screen experiments, 2006). I also analysed possibilities of using 3D spaces in educational platforms, especially including realisation of experiments in such environments (Meger, Interactive Screen Experiments in Collaborative Environment, 2007), what created a perspective for defining a new generation of distant education, about what I inform in my article titled *Szósta generacja nauczania zdalnego/ The sixth generation of distant education* (Meger, 2008).

Analysing other scientific and research achievements, it is worth to mention my participation in an international ESPA-EST program, which was to propose innovative solutions in the field of distant learning of foreign languages. As a scientific manager, I proposed collaborative solutions, which simultaneously with learning Spanish, enabled launching collaboration in the field of business. I published 8 works in this subject area. Brief discussions on this issue are presented in the work titled *ESPA-EST - konstruktywistyczne podejście do języków obcych/ ESPA-EST - constructivistic approach to foreign languages* (Meger, 2007).

As far as scientific and research achievements in pedagogy are concerned, I must mention globally unique summary of trends in education, which I specify using consecutive letters in combination with the term *learning*, e.g. *e-learning*. I proposed naming of the first trends at the conference *E-learning as a Method Supporting Education Process* (Meger, A-Learning, action-Learning, active-Learning, 2006). Interesting solutions are proposed by modern m-learning, what I discuss in my monograph *E-learning w szkolnictwie wyższym/ E-learning in higher education* (Meger, Przegląd rozwiązań w zakresie m-learningu/ A review of solutions in m-learning, 2010). A full list from *a-Learning* to *z-Learning* is presented in the monograph *Postępy e-learningu/ Progress of e-learning* (Meger, (Meger, Tendencje współczesnej edukacji - od a-Learning do z-Learning/ Tendencies of modern education - from a-Learning to z-Learning, 2010). It seems that this conceptualisation is not only interesting and unique in the global scale, but also very valuable, despite not being disseminated. It would not be possible without analysing numerous published works, what is efficiently supported by the database system for analysing of literature - LiDa.

I used LiDa system also in other studies of literature. Among most interesting works developed in such way I could include *Paradoks czasu w e-learningu/ Time paradox in e-learning* (Meger, 2006), where I analyse time from the philosophical and historical perspective, from Saint Augustine to modern times. In the context of e-learning, it turns out that something that was to last short, always lasts longer. I like to speak about paradoxes during conferences, e.g. paradox of cooking eggs states that the more eggs we cook in a pot, the less water we need (and eggs will be cooked faster). This situation surprisingly fits to conditions of modern e-learning.

Although LiDa database mostly includes references to foreign works, nearly 20% of data concerns Polish scientific publications. Appreciation of Polish scientific contribution in the world's pedagogic thought, concerning education assisted with technologies (including collaborative education) became an aim of my work during recent years. One occasion was related with a rapid development of social networks. It turns out that an often way of keeping contact in such networks is phatic communication. In such communication, content is not relayed, but it serves only and solely for maintaining contact. It has a significant importance also in collaborative education. The father of phatic communication is Bronisław Malinowski. Considering the context of communication in modern social media, I discuss this issue in Edu@kcja magazine (Meger, Co łączy Bronisława Malinowskiego z portalami społecznościowymi?/ What does Bronisław Malinowski have in common with social media?, 2012). As Critics regarded the article as not scientific, I place it in the list of didactic achievements. Nevertheless, I assume - although I can be wrong - that no one else in Poland noticed this obvious, as well as important, relationship of phatic communication, omnipresent in social networks, with this Polish scientist. It is a pity as it is a great occasion to promote Polish science. Promotion of Polish science is also a task of science, a very important task.

* * *

A detailed list of didactic and popularisation output, as well as information about international cooperation, is presented in 9 pages of the attached documents, titled *Wykaz opublikowanych prac naukowych lub twórczych prac zawodowych oraz informacja o osiągnięciach dydaktycznych, współpracy naukowej i popularyzacji nauki/ List of published scientific works or vocational works, and information about didactic achievements, scientific cooperation, and popularisation of science* (total volume of the document: 30 pages). Here, I would like to mention only the international activities and the aspects of didactic output, which are related with scientific achievements.

As far as my international cooperation is concerned, apart from the four-year period of occupation at scientific centres in Germany (most of all: Humboldt-Universität, Technische-Universität, and Freie-Universität in Berlin), I must mention management over the scientific project *Computerlehrlabor für Lehrerausbildung und Forschung* (Didactic computer laboratory for educating teachers and conducting research). That project, completely financed by Deutscher Akademischer Austauschdienst (DAAD), enabled getting knowledge about very modern of that time technology of computer assisted physical experiments. New system CASSY was a substantially more expensive alternative for COACH system that was popular in Poland, also having incomparably greater capabilities. Presenting information about potential use of

CASSY during conferences in Poland undoubtedly had an influence on perception of new possibilities in the scope of natural experiments. The project played also an important role in education of teachers.

During my didactic work, I also participated in international studies on education of teachers of physics, conducted in the years 1992 - 1995 in former countries of Comecon. As a coordinator of Polish part of the research, I participated in their presentation abroad, e.g. during conferences in Freiburg (1994) and Kiel (1995). The studies indicated a relatively high share of practical classes in the Polish system of educating teachers of physics, what is positively reflected in results of the whole process of education.

A significant part of my scientific and didactic work (over 11 years in total) was related with the function of Deputy Dean for education (at the Pomeranian University) and Dean (at the University of Social Sciences). It was related with numerous additional responsibilities, like chairing thousands of committees (mostly diploma exam committees - from dozens to over 100 per year), and in the scientific context, with acquiring and settling funds for education, as well as preparing numerous scientific reports, included those related with scientific activity of departments. Although, working on reports is not so visible, it is not a basis for publications and does not provide points and other profits, such work is composed of at least several hundred of pages of my personal contribution. A clear effect of that work was constant growth of expenditures on financing scientific activity of represented departments, thus, an indirect contribution in the development of science in local environments.

Works related with the development of the first computer network in the university in Słupsk was significant for the development of the local scientific community. As a proxy of His Magnificence Dean and a coordinator of IT tasks, I was a head of numerous tender committees, supervised the construction of the network and equipping institutes with computer hardware. I prepared a server and email accounts for all (about 200) employees of the Faculty of Mathematics and Environmental Science of the Higher School of Pedagogy in Słupsk. Although not being strictly scientific activity, this work for sure had an influence on the progress of scientific level of the Faculty.

I was a thesis supervisor or a reviewer of about 100 B.A., engineer, M.A. theses and theses at postgraduate studies. My care over students was often very intensive, I devoted many hours for that, preparing common useful solutions. One example of such achievements is developing a computer application for explaining the phenomenon of Doppler effect in spectra of binary stars. The phenomenon is quite complex and very difficult to be explained, however, using a properly prepared multimedia program, it can be easily depicted. Works of such type, performed by students individually or with my supervision, are a solution for numerous detailed issues of multimedia presentations for didactic aims. IT students (engineer theses), with my supervision, realised works, which, using small microprocessor systems, depicted complex automatics systems. Such solutions also fit in scientific searches in the field of possibilities of supporting education by computer technologies.

Reviews in the area of the branch of science that I represent were also related with scientific studies. Reviews of national and international projects were realised by the order of the Ministry of Science and Higher Education - National Information Processing Institute and Foundation for Polish Science. I also reviewed works in international thematic monographs. Details are included in the attached list.

I prepared also *International Conference on E-learning in Education* in Warsaw (2006). Due to holding the position of a dean, I participated in organisational works during many other scientific conferences. What is more, I am often playing the role of a chair of conference sessions - in Poland and abroad.

Details concerning the above mentioned achievements as well as a detailed list of scientific works and other output, are presented in the List *of published scientific works or vocational works, and information about didactic achievements, scientific cooperation, and popularisation of science*. Each point in 28 part of the list includes from 1 to 49 pieces of information (publications) concerning meeting each criterion.

Finally, I would like to mention that I am fluent in English, German, and Russian, what surely results from continuous tracking and reading foreign literature. What is more, basic literature related with computer technologies was originally available only in English. Currently, reading English or German websites is not a problem. I do not even notice the language of a particular site. Many years stay at scientific centres in Germany, two monographs written by me in German, one translation of a book into German (by the order of *Institut für Pädagogik der Naturwissenschaften Kiel* - The Institute of Pedagogy of Natural Sciences in Kiel) prove a very good knowledge of German.

To sum up, I think that one of my greatest achievements is developing bases of the strategy of collaborative education, which, apart from strategies of teaching and learning, can become a significant element of education of a new generation of the network learners. I achieved that by formulating two questions (scientific problems) at the beginning of my scientific activity, which I explored in the course of consecutive studies and developed by setting new detailed research aims and problems. Solutions of these problems are always original, and some of them (e.g. determining the place of the Shannon theories or conceptualisation of trends in education) constitute my personal contribution in the global pedagogy. I express my opinion, although I can be wrong, that the collaboration strategy, after proposing specific methodical solutions and dissemination of new forms and methods of work, will become one of the most important educational strategies of future generations.

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