FIELDS FOR/OF CREATIVITY IN DISTANCE LEARNING

Jolanta Krzyżewska
Department of Humanistic Education and Auxiliary Sciences of Pedagogy,
Faculty of Ethnology and Sciences of Education, University of Silesia
jjoka@poczta.onet.pl

Abstract**:** *Extending applications of computer technologies in distance learning make it similar to all other forms or modes of education. In distance learning, both in its strict sense and broad sense (of education with the computer), there are vast possibilities of applying the assumptions of creative teaching, similarly to other educational forms. These possibilities depend not only on people's (self-)awareness but also (proportionally to it) on the possibilities of more and more advanced computer programmes (software). This positive feedback results in constant increasing of the Turing's test requirements as a specific measure of the technology defining modern times.*

Keywords: artificial intelligence, cognitive psychology, creativity, creative education, distance learning, Turing's test

INSTEAD OF INTRODUCTION – ASSUMPTIONS/RESERVATIONS

The title wording might generate various associations and expectations concerning the directions in which they can develop. All of them cannot be explored in a relatively short text. What will be not presented here either is an (open by nature) list of these associations, although this might be formally desired and heuristically interesting. Thus, some considerations resulting from the applied "path" of reasoning will be provided to the Reader, activated only by some of the associations. Before appropriate analyses are started, some assumptions and reservations will be formulated which will dismiss some of the expectations. The assumptions and reservations will be treated altogether as one category of justifications or rights, doing justice to "ontological accuracy" just by "graphics of the slash". With a lot of simplification, it can be said that the assumptions have positive nature and they indicate the prospects, whereas reservations concern limitations of reasoning.

Such introductory remarks can specify what might be expected in the text and what rather might not.

The assumptions/reservations are as follows.

- The discussion will be conducted from the standpoint of cognitive psychology of creativity and its effects will be formulated exclusively in its language. What arises here is a strong temptation to add that this concerns the so called "pure" psychology - such which does not tend to generate, within its notional apparatus, various kinds of additional meanings (Madsen 1980), especially those of neurophysiological nature. Facing more and more tight and complicated relations which modern psychology (and cognitive psychology in particular) enters within its subdiscipline of cognitive science, it should be doubted whether this is still possible.

- Such traditional (in its best meaning) interdisciplinarity of the approach does not exclude drawing from the output of other subdisciplines of cognitive science - the comments on challenges and expectations concerning interdisciplinary approaches can be compared here (Juszczyk 2002, p. 86). However, such threads appear in this study merely as signals. These references seem inevitable and can be confirmed by the so called computer metaphor, which successfully applied in cognitive psychology makes one aware of the dual orientation of cognitive studies. A slightly humorous impression is made currently that it is not known what is modeled by what: computer programme functioning by functioning of human mind or the opposite. Among other things, it is the effectiveness of the computer metaphor which causes that cognitive psychology cannot be defined (a bit intuitively and thus imprecisely) any longer by indicating the field which it explores (broadly or narrowly understood cognition). Nowadays, this is done by indicating the categories used for theory building and for designing empirical studies. Psychology is "cognitive" not because of what it explores but how it deals with its subject matter, which for modern psychology is a much larger area than before. Not only theories of cognition itself are "cognitive" but also theories of what was not earlier considered cognitive or was even opposed to cognition (emotions, motivation, personality). Currently, cognitive attempts at conceptualization of emotions, motivation or personality are regarded as obvious in psychology (which does not exclude "non-cognitive" attempts of their conceptualization).

- The issue of the organization of the didactic process is not the appropriate subject matter of the discussion, either. Pedagogical, didactic and methodological threads (if they can be found at all) constitute only its peripheral part.

- The remarks concerning the possibilities of computer programme do not aspire to compose a systematic vision of cognitive character. This concerns general references to broadly understood artificial intelligence, which are inevitable and appear in this study on some occasions. What is left to the Reader's competence is developing them in different directions.

1. (NONSPECIFIC) SPECIFICITY OF DISTANCE LEARNING

Among numerous terms used in expert literature on this relatively young form of education, the term "distance learning" seems the most favourable due to its

broadness (more details on the ranges of the applied notions can be found in Juszczyk 2002; Kubiak 2000), as a result of which the following cannot be determined:

- the particular stage of education (elementary school, lower- or upper-secondary school, university or post-graduate studies);
- the number and character of educational areas (general, specialist education);
- the level of institutionalization of education (organized school education, home schooling);
- the proportions of its various forms in the whole educational process (traditional teaching with a teacher, self-education);
- the role of another person in education (independently from this person's status – teacher, partner, co-worker, etc.);
- the specificity of the arbiter who evaluates the effects (teacher, team of experts, qualification commission, the learner him/herself, etc.);
- the level of application in education of any technological elements – including (and first of all) the computer.

This (certainly incomplete) list suggests and emphasizes various doubts concerning the specificity level of the discussed modern and expanding form of learning – the doubts which might appear already in the very beginning (at the level of defining):

> Distance learning is a method of conducting the didactic process when teachers and learners are (sometimes substantially) distant from each other, are not in the same place and they apply for the sake of information flow (apart from traditional ways of communicating) contemporary, very advanced telecommunication technologies by sending: voice, video vision, computer data and printed materials. Modern technologies also enable direct contact in the real time between the teacher and the learner owing to audio- or video-conferences, regardless the **distance** which separates **them** [this and all other highlightings in quotations – JK]. (Kubiak 2000: 12)

Not going into deep and detailed analysis of the doubts or particular ideas comprised in this quotation, it is enough to state, slightly paradoxically, that even such a broadly interpreted category "distance learning" starts to live its own life, not rendering (any more) its full meaning. What tends to be uttered is the changed ending of the last sentence – "… which connects them".

What has been already recorded in expert literature is the consciousness of multiple senses applied to describe this form of science as simply "education with the computer". Such category directly appears in the title of a collective work on this

issue (Siemieniecki 1999). This outlines much broader fields for applications of the computing machine in education:

> The universality of applying computer tools in social life has its particular consequences in education. Here, the computer is not **another didactic means**, as it may seem, but a powerful **tool for man's intellectual support**. This fact makes the introduction of computers to education result in multiple consequences. (Siemieniecki 1999b: 5-6)

These consequences are catalogued by researchers in the form of numerous lists of specific qualities which such a mode of education presents (Kubiak, 2000; Smyrnowa, Stach, 2012). Some are formed in the language more or less axiologically marked – apart from the terms defining the extent of effectiveness of distance learning, its advantages and disadvantages are discussed (Gałek 2003; Kamińska-Czubała 2003; Próchnicka 2003; Woźniak 2009; Siemieniecki 1999a), as well as its threats (Wieczorkowski 1999; Rutkowska 2002). Without going into details of this motif, the statement only will be pronounced here that these advantages and disadvantages are frequently diagnosed:

- inconsistently – a particular phenomenon is regarded as advantage by some researchers and as drawback by others (Wieczorkowski 1999). What may seem controversial is that Wieczorkowski regards predisposition to self-education as a drawback and limitation. (op. cit., p. 136).

- mutually contradictory – even the same phenomenon can be interpreted as advantage or disadvantage at the same time (Gończ 2002; Wieczorkowska-Wierzbińska 2011). This situation is cognitively interesting as it allows for regarding a particular phenomenon as multidimensional, as a result of which the contradiction might turn out to be apparent. Still, this is also a natural situation as it is related to gradual development of studies into the effects of distance learning. Discovering this multidimensionality can be clearly seen in the history of this research – what should be referred to are the early reports issued several years ago, which were often limited to a laconic and vague statement of the fact on one hand and, on the other, were over-emotional descriptions not confirmed by reliable empirical data and containing elaborated and deepened contemporary analyses.

- both within social or emotional functioning of the learner and within the learner's "purely cognitive" functioning (Wieczorkowska-Wierzbińska 2011). This issue is of due significance for the presented vision of the role of creativity in distance learning.

However, at least two facts deserve elaboration and deeper analysis:

– absence or "trace" manifestation of creativity in expert literature evidently on the side of advantages, not mentioning even the chances and prospects of creativity as an absolutely indispensable quality of contemporary education;

– traditional interpretation of creativity as an exclusive and elite activity, scarcely practicable with the help of such a tool as a "ready" programme of the computing machine; such a state may partially result from implementing one of the assumptions of distance learning which allows for (imposes?) leaving a part (usually expressed by percentage) of a particular course for face to face implementation.

What can be allowed here is formulating the hypothesis that this is not the specificity of distance learning. Elements of the so called creative teaching are not present to such an extent and sense which might be expected at any stages (in institutionalized forms) of contemporary education in Poland. It is an "unbearable" paradox that this takes place in the times of general (almost omnipresent) calling for creativity in almost each human activity and in the times of great boom in theoretical concepts and empirical studies on creation. This is a kind of generalization (probably unjust for many creative didactics and methodology practitioners) and the topic itself exceeds the framework of the present discussion.

2. INTELLIGENT TEACHING – CREATIVE TEACHING

Considering fields in education, it is indispensable to refer to the research into artificial education (in all meanings of this term). Its results have found applications in designing distance learning, according to one idea currently regarded as classical:

> The variety of computer applications for educational goals is huge and the same number can be worked out for the applications of artificial intelligence (…). All forms of education based on using the computer offer the possibility of automatic data collection and practicing some form of controlled manipulation. However, I would like to focus on a special paradigm of **intelligent teaching,** called model-tracing, which is particularly appropriate for pedagogical aims. (Anderson 2007: 45)

Although creativity is not straight named here ("merely" intelligence is mentioned), this idea seems to herald the direction of further evolution to which computer programming should be subjected. This will help to make the next step – twisting Anderson's phrasing, to be able to talk about "creative teaching". The direction is indicated directly by the highlighted words in the following fragment:

> Methodology of model-tracing requires conducting a simulation of how the examined **should** perform tasks and how they do it **in reality**. [bold type – J.K.] (…) Reports of the learner's real responses and their simulations are automatically recorded. (…) at each point, the teacher can make use of the rich interpretation of the learner's probable mental states. The precise way of re-formulating the teacher's cognitive interpretation into teaching methods depends on the theory of learning. On the basis of ACT* theory, we

> elaborated on a set of cognitive principles of teaching which are mostly based on immediate feedback. (op. cit., p. 46)

These principles constitute a harbinger of the next level in increasing the Turing's test (regardless the application of the "weak" or "strong" understanding of the category "artificial intelligence"). A specific key to designing such a "higher crossbar" for a machine is the decision concerning the appreciation of the psychological perspective (Flasiński 2011) in designing the "artificial creator". What is referred here by applying this slightly eccentric term is the idea of Miłkowski, the author of the category "artificial intelligent person" (quoted in: Labenz 2004). It is this perspective which enables applying - in such designing – the analysis of errors made by people in the process of task solving. This is done at least in two ways:

- in order to diagnose the errors and eliminate them from computer programme functioning by improving or perfecting it in an identical task situation as occurs in human functioning;
- in order to make use of the error in designing the functioning of the machine programme – to make use in its full sense of "building in" this error as a regular tool and a constructive stage in the process of solving.

It seems obvious that the first possibility, due to its nature, leads to improving the functioning of the machine. Yet, this is the second possibility which enables introducing the elements of creativity into the model of better functioning. This occurs because human creativity appears as a sophisticated, emergent and slightly weird phenomenon. What ranks as most important is that it has less in common with intelligence (familiar to researchers into AI) that it might seem. Not going into details, psychologists generally agree that intelligence and creativity due to their nature are two independent variables. The fact that intelligence can modify (strengthen) functioning of creativity (and it is good when this occurs) does not bear other possibilities of relations between them. Therefore, creative solutions are possible in the case of people of little intelligence, as well as in the case of small children who are still not in the developmental stage of formal operations or the elderly, whose formal operations function worse or are substituted by post-formal operations. Due to this , attempts to stimulate human functioning by the computing machine seem to be very difficult and judged as unfeasible or even nonsensical (Mirski 2000: 112-113). On the other hand – they raise hope for perfecting its functioning, which can occur "from a slightly different side". What is not nonsensical any longer is the permanently current question: how many of routine human activities can be (already) entrusted to the machine? The fact that such attempts are not any longer a common (irritating or even frightening) futuristic fantasy and that the idea of AI itself is not an "illusion or pseudo-problem" (Szumakowicz 2000b: 5) can be confirmed by the organization of the first conference dedicated to "creativity of computers" in 2010 at Coimbra University (Flasiński 2011: 240).

3. FIELDS OF CREATIVITY - HOW TO FIND THEM?

The image of the creative man is shaped by contemporary psychology of creativity (Nęcka, 2001) according to the following assumptions:

- creativity is of more egalitarian than elite character;
- the creative process basically does not require participation of any separate or specific structures and mental processes;
- even though the key element of the structure and course of creative activity consists of cognitive processes and structures, this activity is not limited to them; modern studies on creativity reveal a significant role of motivation and emotions (Tokarz 1991; Kocowski, Tokarz 1991);
- even though the key element among cognitive constituents of creative activity is thinking, other cognitive processes have significant influence on its course; it seems sufficient to mention the research into the role of attention (Kolańczyk 1991), memory or language (Mudyń 1991);
- creative activity presents its dialectical nature;
- creation is subjected to rules of training.

It can be said briefly that creative activity requires specificity in the functioning of:

- perception – independent from the field, therefore allowing for collecting information not necessarily needed in a particular situation but situated in appropriate memory stores "at the disposal";
- attention – simultaneously intensive and extensive, with a slight advantage of the latter, especially at the green light stage, when access is needed to various data;
- imaginations – permeating the stage of generating ideas with them, with appreciation of eidetic imaginations and the ones generated in different sensory codes;
- learning processes – a specific and at the same time unspecific transfer, with slight advantage of the latter, responsible for creating foundations for using heuristics;
- memory – its each type though with particular appreciation of semantic memory and reminiscence effect, which is sometimes called the memory insight;
- reasoning at the level of rules – with definitely more heuristic than algorithmic ones, especially in the green light stage;

- reasoning at the level of operation – abstracting on the basis of not necessarily significant (but also "strong") qualities, making remote associations according to the chain model, "over-meticulous" and "over-consistent" deductive reasoning, inductive reasoning based more on carrier than accurate analogy, more carrier than accurate use of metaphors, complicated transforming in various information codes (especially, the so called conceptualization of imaginations and visualization of notions);
- reasoning at the level of formal qualities of its course – appreciation of its divergent direction apart from the convergent one (particularly in the green light stage), non-linear structure and possibly numerous cases of insight;
- motivation – appreciation of its para-intentional version, sometimes called "motivation without motivation" – motivation of ludic (not task-based), autonomic (not instrumental) and internal character; this is an academic, canonic case of creative motivation; as such, it provides a kind of "mental *perpetuum mobile*" – satisfaction, which activates the next creative process, is drawn from activity itself, not necessarily from information about the result (which might not appear at all); according to researchers, creative activity can be started basically by each kind (even the most instrumental) of motivation;
- emotions – among other things, making use of the effect of special balance between requirements and possibilities (flow), the so called paternal effect (related to the feeling of authorship) and various background emotions as creativity stimulants - also in spite of failure or even against it (Czsiksentmihaly 1998);
- personality (a number of variables, not always useful in contrary task situations) - it seems impossible to enumerate these variables without the risk of simplification. The following should be sufficient: lack of excessive sensitivity to public opinion, criticism towards the authorities, and not falling into excessive (self-) criticism. Another group of such qualities comprises tolerance for the lack of information, information incompatibility, notional conflict, as well as readiness for undertaking new and difficult tasks. Some of them are accurately and reliably diagnosed by the Big Five.

The image outlined above indicates directions for the search of creativity fields in contemporary distance learning at the level of:

1. types of the presented tasks;
2. types of the provided materials;
3. types of the expected solutions;
4. types of the accepted activities;
5. evaluation standards;

6. the teacher's role/rank;
7. the applied model of distance learning;
8. the extent to which the computer is used.

1) This regards not only the change of proportion of strictly task situations (in which the solving process may be limited to the application of known and tested algorithms) and problem situations (the solving of which requires the application (or firstly creation) of heuristic rules) in favour of the latter. The change of proportion at the earlier stage is also dealt here – the appreciation of independent searching and formulating problems in relation to their "mere" solving. It seems that in this respect, distance learning does not need to be restricted by any conditions.

2) As regards the teacher, this consists in providing the most diversified materials and most authorial ones; in the case of the learner – the broadest use of multimedia bases. Such multimedia approach is beneficial for creative translation of information codes. The broadness of information does not need to result in superficiality of education (this is a frequent charge addressed to distance learning - supported by the studies which unmask the myth of multitude of tasks as a positive phenomenon); just contrary – due to extensive attention, it enables creative treatment of information.

3) Not each educational task has to be of *par excellence* creative character; on the contrary – there are many tasks which should be solved quickly, automatically and with the help of well-tested algorithms; otherwise, the time-consuming creative approach to everything would become a disproportionate educational cost. However, learning simple mathematical formulas or English irregular verbs may involve creative elements, based on highly individualized mnemonic activities involving the semantization of individual experience, verbal games and linguistic jokes (noticing the relation sound/graphical representation – meaning) or on noticing formal qualities of patterns (symmetry, repeatability of expressions). Needless to say that the computer which is much faster than the human mind might "suggest" many ideas in this respect. The acceptance of such learning imposes only two conditions – the teacher's appreciation of another form of recording knowledge in the learner's memory and a sensible balance of profits and losses of generating and maintaining the developed strategy.

4) Solving problems (especially those with substantial shortage of initial information) does not always result in achieving the aim in the assumed extent or may fail to achieve it at all (even after several attempts). Appreciation of the solving process itself is important – this is not only the learner's role but also (and first of all) the teacher's. It is sometimes enough not to hasten with the phrase "This is a wrong solution". A deeper analysis of particular phases of the solving process might indicate some valuable

fragments of reasoning. The computer will allow for relatively fast confrontation with alternative solutions (especially in the model involving cooperation and work in creative thinking groups).

5) Establishing evaluation standards is one of few autonomic roles of the teacher (not necessarily fulfilled alone). The teacher should see to it that the standards take into account a maximal number of parameters of the obtained solution and that they are not patterns of thought used for many years. In this respect, the teacher turns out to be also a distance learning participant by reaching for other experts' opinions or opinions of computer expert systems.

6) The teacher is not any longer the only or even major source of knowledge for the learner. S/he should become rather an animator and guide in the selected individualized educational path. However, in the face of "information flood", it is in this role that the teacher will function the more effectively, the more classical and universal tools for ordering this flood s/he will suggest. They are likely to be found in classical philosophical literature.

7) Two basic models of distance learning discussed in expert literature (Potulicka 1988) do not exclude but rather supplement each other. Aiming at broadening the range of both group and cross-group cooperation tasks in solving educational problems does not bear virtues of individuality and autonomy (or even the niche character) of a particular learner's knowledge. The model is creative by nature and its implementation "from the distance" allows for emphasizing the merits of the work performed by the collective creative mind (time saving, synergy) with simultaneous weakening or eliminating its drawbacks (abandoning or alleviating the fear of appearing ridiculous due to "covering" with a computer).

8) Multifunctionality of the high generation computer is the foundation of the search for creativity fields. This consists in a specific courage to treat it as an "extraordinary" tool – not only as a data provider but also as a kind of the "alter ego" of the creative mind.

INSTEAD OF ENDING – WILL THIS BE CONTINUED?

Creativity itself and creativity in education in particular is an expensive (also time-consuming) activity. Therefore, what has become a necessity is including the computer (programme) into education in the distinguished fields. This does not regard the fact but the extent. The prospects substantially depend on the sensible alternative to commutative approaches in programming the functioning of the machine:

> Maybe when calculations become sufficiently complicated, they acquire the qualities of subjectivity and creativity, which are associated with the notion of

> "mind". Yet, it is hard to get rid of suspicions that in such an image of reality something is missing. (Penrose: 489)

Moreover, the prospects depend on noticing the right relation between AI and AC. The contemporary psychological approach to creativity suggests directions of the search for it. For the time being, it can be said that what currently lasts is the "calm and heuristically polite" simulation phase, which results in "mere" supporting human creation by the machine. However, the aggregation phase will take place soon, in which the programme of "creative computer", designed with "cognitive spirit and swing", will increase the TT crossbar for the creative man. In this sense, the "futuristic cranking" of the next phase can be accepted because at this stage (limited?) substitution will be already possible. This is an echo of Bolter's idea: the Turing machine gave birth to Turing's man and this man to another machine – and so on in a circle in accordance with positive feedback.

REFERENCES

Anderson, J., R., 2007: *Methodologies of human knowledge research.* n: Chlewiński Z. (ed.), 2007: *Cognitive psychology of last three decades of 20-th century,* first edition, GWP, Gdańsk, pp. 27-52, ISBN: 83-60083-16-9 [In Polish]

Bolter, J., D., 1990: *Turing's Man: Western Culture in the Computer Age,* translated by Goban-Klas T. PIW, Warszawa, 83-06-01940-7 [In Polish]

Czsiksentmihalyi, M., 1998: *Every day's charm. Psychology of emotional flow.* Wydawnictwo W.A.B., Warszawa, ISBN: 83-87021-47-4 [In Polish]

Flasiński, M., 2011: *Introduction to artificial intelligence.* Wydawnictwo Naukowe PWN, Warszawa, 978-83-01-16663-2 [In Polish]

Gałek, H., 2003: *Distance learning course making,* In: Kocójowa M. (ed.), 2003: *Distance learning. New information and library technologies.* First edition, Wydawnictwo UJ, Kraków, pp. 55-59, ISBN: 83-233-1750-X [In Polish]

Gończ, E., 2000: *Distance learning – trend or chance?,* In: Wrycza S., Wojtkowiak J (eds), 2000: *Distance learning. Challenges - trends – applications.* Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, pp. 36-58, ISBN: 83-7326-064-1 [In Polish]

Hetmański, M., 2000: *Mind and machines. A critics of computational theory of mind* Wydawnictwo UMCS, Lublin, 83-227-1602-8 [In Polish]

Juszczyk, S., 2002: *Distance learning. Concepts, rules and processes - codification.* Wydawnictwo Adam Marszałek, Toruń, ISBN: 83-7322-291-X [In Polish]

Juszczyk, S., (ed.), 2000: *Interactive communication between man and computer*. Oficyna Wydawnicza „Impuls", Kraków, ISBN: 83-88030-48-5 [In Polish]

Kamińska-Czubała, B., 2003: *Educational web platforms* in: Kocójowa M. (ed.), 2003: *Distance learning. New information and library technologies.* first edition, Wydawnictwo UJ, Kraków, pp. 70-78, ISBN: 83-233-1750 X [In Polish]

Kocowski, T., Tokarz, A., 1991: *Procreative and anticreative mechanisms of creative activity*. In: Tokarz A., (ed.), 1991: *Stimulators and inhibitors of creative activity.* SAWW, pp.79- 95 [In Polish]

Kolańczyk, A., 1991: *Function of attention in process of creative intuition.* In: Tokarz A., (ed.), 1991: *Stimulators and inhibitors of creative activity*. SAWW, pp. 33-48 [In Polish]

Kubiak, M., J., 2000: *Virtual education. School, Internet, Intranet.* Wydawnictwo „MIKOM", Warszawa, ISBN: 83-7279-032-9 [In Polish]

Labenz, P., 2004: *Conversational artificial intelligence; from Turing to Potiomkin.* In: Szymanik J., Zajenkowski M. (eds), 2004: *Cognitive science. Thinking about the mind – deliberative and undeliberative*. Koło Filozoficzne przy MISH UW, Warszawa, pp. 95-112, ISBN: 83-915323-2-1 [In Polish]

Madsen, K., B., 1980: *Modern theories of motivation.* translated by Jakubczyk A., Łapiński M., Szustrowa T., PWN, Warszawa, ISBN: 83-01-00402-9 [In Polish]

Mirski, A., 2000: *Natural and artificial intelligence or agent and object intelligence.* in: Szumakowicz E., (ed.), 2000: *Limits of artificial intelligence. Essays and studies.* Wydawnictwo Naukowe DWN, Kraków, pp. 83-114, ISBN: 83-7242-119-6 [In Polish]

Mudyń, K., 1991: *Language inspired social limitations of cognition – their overcoming by language operations*. in: Tokarz, A., (ed.), 1991: *Stimulators and inhibitors of creative activity*, SAWW, pp. 20-32 [In Polish]

Nęcka, E., 2001: *Psychology of creativity*. GWP, Gdańsk, 83-87957-50-X [In Polish]

Penrose, R., 1995: *The Emperor's New Mind: Concerning Computers, Minds and the Laws of Physics*. transl. by Amsterdamski P., PWN, Warszawa, ISBN: 83-01-11819-9 [In Polish]

Potulicka, E., 1988: *University distance learning in west Europe and America. Institutions, theories, goals of programs and methods projects – developmental trends and typology*. Wydawnictwo UAM, Poznań, ISBN: 83-232-0089-0 [In Polish]

Próchnicka, M., 2003: *Information behaviour of participants in distance learning*, In: Kocójowa M. (ed.), 2003: *Distance learning. New information and*

library technologies. first edition, Wydawnictwo UJ, Kraków, pp. 126-132, 70-78, ISBN: 83-233-1750-X [In Polish]

Rutkowska, L., 2002: *Distance learning – methods and software.* In: Wrycza S., Wojtkowiak J. (eds), 2002: *Distance learning. Challenges - trends – applications.* Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, pp. 59-82, ISBN: 83-7326-064-1 [In Polish]

Siemieniecki, B., 1999a: *Common applications of IT – their effects.* In: Siemieniecki B. (ed.), 1999: *Education with computer – future perspectives.* Adam Marszałek, Toruń, pp. 39-50, ISBN: 83-7174-212-6, ISBN: 83-7174-481-1

Siemieniecki, B., 1999b: *Introduction,* In: Siemieniecki B. (ed.), 1999: *Education with computer – future perspectives.* Adam Marszałek, Toruń, pp. 5-7, ISBN: 83-7174-212-6, 83-7174-481-1 [In Polish]

Szumakowicz, E., 2000a: *Artificial intelligence – problem or pseudoproblem?* In: Szumakowicz E. (ed.), 2000: *Limits of artificial intelligence. Essays and studies.* Wydawnictwo Naukowe DWN, Kraków, pp. 11-42, ISBN: 83-7242-119-6 [In Polish]

Szumakowicz, E., 2000b: *Introduction.* In: Szumakowicz E. (ed.), 2000: *Limits of artificial intelligence. Essays and studies.* Wydawnictwo Naukowe DWN, Kraków, pp. 5-7, ISBN: 83-7242-119-6 [In Polish]

Smyrnova-Trybulska, E., Stach, S., (eds), 2012: *Using LCMS Moodle as a system for distance learning support*. Studio Noa, University of Silesia, Katowice. ISBN: 978-83-60071-56-4

Tokarz, A., 1991: *Emotions and its stimulators in creative process.* In: Tokarz A., (ed.), 1991: *Stimulators and inhibitors of creative activity*, SAWW, pp. 96-110 [In Polish]

Wieczorkowska-Wierzbińska, G., 2011: *Psychological limitations.* Wydawnictwo Naukowe Wydziału Zarządzania UW, Warszawa, ISBN: 978-83-61276-64-7 [In Polish]

Wieczorkowski, K., 1999: *Distance learning – its present and future.* In: Siemieniecki B. (ed.), 1999: *Education with computer – future perspectives,* Adam Marszałek, Toruń, pp. 107-42, ISBN: 83-7174-212-6, ISBN: 83-7174-481-1 [In Polish]

Woźniak, J., 2009: *E-learning in business and education.* Wydawnictwa Akademickie i Profesjonalne, Warszawa, ISBN: 978-83-7644-031-6 [In Polish]