Epistemological Reflection in Contemporary Teachers' Training

Teachers as Architects of Their Own Knowledge

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The educational system of teacher training in Poland is focused on developing professional competencies, mainly didactic, directly involved in the process of teaching particular school subjects. The absent element is epistemological reflection, understood as an ability to critically reflect on the essence of knowledge and knowing process. Such reflection stands at the core of teachers' professional development, it being the critical condition of constructing personal epistemology.

The aims of this chapter are to examine the dimensions of epistemological reflection, to explain its influence on teachers' personal theories and hidden presumptions concerning knowledge and learning, as well as to explain the role of epistemology in teachers' training. Theoretical considerations are illustrated with examples of students' drawings and statements, collected during the action research study on in-service teachers' concepts of the mind/learning.

Keywords:

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phenomenographic interviews

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Introduction

Kathleen Forsythe argues that contemporary teachers are neither the owners nor the transmitters of knowledge – "they are and they should be perceived as knowledge architects" (cited in: Dylak, 2013, p. 170). The knowledge architect is a "strategic designer who opens new dimensions of working and learning space by developing new infrastructure for human interactions" (ibidem) – he develops the educational space where deep, meaningful communication can take place. An architect who is able to build knowledge structures in himself and in his students not only must be aware of his own knowledge (its credibility and justification) but should also be able to confront his epistemological reflection with others, to express it clearly or even bring it into question, challenge it, deconstruct it and reinterpret it if necessary. The article presented here concerns epistemological reflection as a keystone in the pedagogical profession, it being the critical condition of constructing personal epistemology. The aim of this chapter is to explain the impact of epistemological reflection on teachers' personal theories and hidden presumptions concerning knowledge and learning.

The first, theoretical part of the article is to provide a short overview of different pedagogical and psychological concepts of personal epistemology and their methodological consequences. The role of epistemological reflection in teacher training is explained. The second, empirical part of the article will present the study designed as action research included in a post-diploma degree for teachers seeking the possibility to change the course of their pedagogical career in "Early Childhood Education and Care". Phenomenographic interviews based on projective drawings are presented and analyzed in terms of the conceptions of mind and knowledge underlying teachers' explanations. The presentation of the research results will be concluded with a short description of the methods used to elicit teachers' epistemological reflections in the course of their studies.

Personal epistemology in teachers' knowledge systems

King and Kitchener (2002) define epistemology as "a theory of knowledge, reflecting its epistemological origins in the Greek words 'episteme' (knowledge) and 'logos' (theory)". Therefore, personal epistemology should be seen as an individual theory of knowledge,

a set of layperson's beliefs concerning knowledge/knowing, often activated more or less consciously during a learning process. Regrettably, although the construct of personal epistemology has been a research area in psychology and pedagogy since the seventies, it is still perceived as a sort of umbrella term – broad and complicated, multidimensional but with unclear borders, often employed by researchers to tackle essentially different phenomena. The meta-analyses of over 670 publications conducted by Briell et al. (2011, pp. 8–11) allowed the extraction of over 39 different terms used by researchers to describe human beliefs, attitudes or assumptions related to the nature of knowledge and knowing, e.g. epistemic cognition (King & Kitchener, 2009), epistemological meta-knowing (Kuhn, 2000), epistemic metacognition (Hofer, 2004), epistemic thinking (Barzilai & Zohar, 2014), as well as epistemic orientation, climate, stance, understanding and many others.

Each of these terms implies a multidimensional, complex structure of personal epistemology. At the same time, however, high differentiation can be noticed in the methodologies employed, as well as in the empirical operationalisation of the construct's internal structure. As Hofer and Pintrich pointed out: "There are discrepancies in naming the construct as well as in defining the construct, to the extent that it is sometimes unclear to what degree researchers are discussing the same intellectual territory" (1997, p. 111). Table 1 offers an overview of the most important constructs introduced in the literature along with their definitions.

Table 1. Personal epistemology as a multifaceted concept – an overview of the most important constructs

CONCEPT	DEFINITION
Schommer-Aikins (2002) <i>Epistemological Beliefs</i>	A form of personal, commonsense and emotionally charged knowledge, reflecting assumptions, attitudes and values related to knowledge – a multiple system of beliefs which function more or less independently.
Hammer & Elby (2002, 2010) <i>Epistemological Resources</i>	More fine-grained individual beliefs about knowledge and knowing which have a context-specific and situated character.
King & Kitchener (2002) <i>Epistemic Cognition</i>	The ability to undertake a conscious reflection on "the limits of knowing, the certainty of knowing, and the criteria for knowing" (p. 38) – a monitoring process that occurs in the solving of complex, ill-structured problems. While metacognition allows the individual to monitor and regulate the basic mental processing involved in learning, the epistemic reflection moves the cognition to a higher level, allowing one a) to consider the nature and complexity of the problem/task, and b) to evaluate the proposed solutions, their justification, thoroughness, argumentation used, etc.
Kuhn (2000) <i>Epistemological Meta-knowing/Epistemological Understanding</i>	Epistemological meta-knowing is a more abstract component of metacognition, which refers to an individual's broader understanding of what knowledge and knowing are in general.
Hofer (2004) <i>Epistemic Metacognition</i>	Beliefs about the nature of knowledge (the certainty of knowledge, the simplicity of knowledge, and about the self as a knower) and the nature of knowing (evaluating the source of knowing, determining the justification of knowing, and regulating cognition during knowledge construction).
Feucht (2010) <i>Epistemic Climate</i>	The nature of the knowledge and knowing of a classroom emerging from the personal epistemologies of students and their teachers, as well as from the epistemological underpinnings of instruction and knowledge representations along with the reciprocal relations among these four components.
Barzilai & Zohar (2014) <i>Epistemic Thinking</i>	Encompasses both: <i>Epistemic cognition</i> – defined as thinking about the epistemic characteristics of specific information, knowledge claims, and their sources, as well as engaging in epistemic strategies and processes of reasoning about specific information, knowledge claims, and their sources; <i>Epistemic metacognition</i> – includes knowledge, skills and experiences regarding the nature of knowledge and of knowing strategies.
Feucht, Brownlee & Schraw (2017) <i>Epistemic Reflexivity</i>	An informed and intentional internal dialogue which includes a focus on personal epistemology and leads to transformative changes in educational practices, expectations and beliefs. Reflexivity involves critical thinking that evaluates multiple perspectives in a particular educational context (the 3R-EC model – Reflection, Reflexivity and Resolved Action for Epistemic Cognition).

Source: own design.

One of the main controversies concerns the very nature of personal epistemology: What is the form and internal structure of the construct? Is personal epistemology the coherent and internally structured system of beliefs activated in a particular problem-solving situation? Or it is the process of epistemic understanding/reflecting on the nature of knowledge, or the even more basic pre-conceptions, presumptions, not fully conscious forms of understanding underlying this process? The most widely known and elaborated approach in the literature is that offered by Barbara Hofer, who defines personal epistemology as "an aspect of metacognitive awareness often activated in the knowledge construction process" (2004, p. 43).

According to Hofer, the system of beliefs and assumptions constituting personal epistemology form an internally intertwined, relatively coherent theory, which includes four basic components: (1) beliefs concerning the nature of knowledge (certainty and simplicity of knowledge), (2) beliefs concerning the self as a knower (one's own epistemic needs and dispositions, the ability to undertake critical epistemic reflection, tolerance for uncertainty versus the need for epistemic closure, finding certain detailed answers), (3) beliefs concerning the nature of knowing (the source of knowledge and the justification of knowledge), and (4) regulating cognition during knowledge construction (evaluating the usefulness and credibility of knowledge acquired) (Hofer, 2004, p. 46). All these areas of beliefs are susceptible to development, although the rate and depth of developmental changes are highly differentiated at both the individual and socio-cultural level:

1. Beliefs about knowledge credibility evolve from (i) an absolutist level, where knowledge is perceived as coming from an external source, as having a certain, objective nature, and can be evaluated as right or wrong; through (ii) a relativistic approach, when knowledge is perceived as generated by human minds and therefore uncertain, based on personal opinions which might be freely chosen by and accountable only to their owners; to (iii) an evaluativist approach, where knowledge is susceptible to evaluation and judgements that can be evaluated and compared according to the criteria of an argument and evidence (Kuhn & Dean, 2004, p. 272);
2. Beliefs concerning the complexity of knowledge evolve from perceiving knowledge as a set of isolated, widely known facts/

information to understanding knowledge as a system of internally connected concepts, which can be context-specific, relativistic, and dependent on the situation (Hofer, 2004, p. 46);

3. Beliefs concerning the source of knowledge develop from perceiving knowledge as objective and coming from the external world (books, teachers, professionals) to perceiving yourself as an active subject constructing personal meanings and opinions;
4. Beliefs concerning the justification of knowledge develop from justifications based on objective, empirical facts/evidence provided by experts (knowledge is certain and objective) to the level where the knowledge might be justified by the strength and quality of arguments (knowledge is developed, interpreted and reinterpreted in a particular context) (King & Kitchener, 2004, pp. 7–8).

A quite different paradigm was offered by Marlene Schommer-Aikins (2002), who described personal epistemology as a system of beliefs that are explicitly multidimensional, function more or less independently of one another, and may or may not develop in synchrony. The term "belief" is conceived here as a form of personal, naive and emotionally charged knowledge, grounded in everyday experiences and reflecting assumptions, expectations, values and attitudes which may affect epistemological reasoning in a particular context. In other words, beliefs overlap with knowledge, in the sense that they are possessed by an individual while being affectively charged, not always conscious, having limited access to logic, and resistant to change (Barzilai & Zohar, 2014).

An even more detailed and narrow approach is that of the epistemological resources of an individual. In this paradigm, introduced by Hammer and Elby (2002), personal epistemology is perceived as fine-grained knowledge elements possessed by an individual, less stable or trait-like, the activation of which has a situated, context-dependent and domain-specific character (Elby & Hammer, 2010, p. 410). Some researchers claim that "epistemological resources may gradually evolve into beliefs as they become fully-fledged, articulated and more stable, but such theory-like stability is more of a characteristic of experts than students" (Zohar & Barzilai, 2014, p. 15). Although such studies do not provide a general model of personal epistemology development,

they have great explanatory power for explaining students' approaches to learning and understanding variability in their reactions.

As Briell et al. (2011, p. 10) notice, contrary to the above-mentioned concept-like/conception-oriented approaches are those that consider personal epistemology as a process. As a prototypical example, King and Kitchener (2009, pp. 37–38) suggested a three-level model of cognitive processing necessary to account for complex phenomena involved in metacognition:

1. At the first level – **cognition** – basic cognitive processes are activated, such as computing, memorising, perceiving, reading, calculating, understanding, reasoning, etc.
2. The second level – **metacognitive processing** – requires being able to monitor and evaluate one's progress when engaged in level one tasks, to observe the effectiveness of one's own thinking, to recognise the obstacles and to adjust the learning strategy.
3. At the third, more abstract level – labelled as **epistemic cognition** – individuals are able to consciously reflect on "the limits of knowing, the certainty of knowing, and the criteria for knowing" (King & Kitchener, 2009, p. 38). While metacognition allows the individual to monitor and regulate the basic mental processing involved in learning, the epistemic reflection moves the cognition to a higher level, allowing one a) to consider the nature and complexity of the problem/task, and b) to evaluate the proposed solutions, their justification, thoroughness, argumentation used, etc.

A process-oriented approach is also reflected in such terms as epistemological understanding (Hofer, 2004), reflective judgements that individuals must undertake when confronted with ill-structured problems for which there is no simple, ready-to-be-used algorithm (King & Kitchener, 2004), as well as epistemic reasoning, ways of knowing, epistemic thinking, epistemological reflection, etc. (for an overview and synthesis, see Briell et al., 2011; Urman & Roth, 2010; Bendixen & Feucht, 2010). A vast majority of researchers representing the process-oriented approach try to integrate the previous research results to offer an integrative model explaining the process of knowledge construction. As an example, Barzilai and Zohar (2014) introduced the concept of "epistemic thinking" as a broad process encompassing both:

1. Epistemic cognition – defined as thinking about the epistemic characteristics of specific information, knowledge claims, and their sources, as well as engaging in epistemic strategies and processes for reasoning about specific information, knowledge claims, and their sources;
2. Epistemic metacognition – including knowledge, skills and experiences regarding the nature of knowledge and of knowing strategies in general.

Feucht, Brownlee and Schraw (2017) propose a model of "epistemic reflexivity" as the key to explaining the potential impact of personal epistemology on educational practice. Reflexivity is an internal dialogue which includes a focus on personal epistemology and leads to transformative changes in educational practices, expectations and beliefs. Engaging in epistemic reflexivity can promote deep professional learning and bring sustainable changes in teachers' education.

—— **The role of epistemological reflection in teacher education**

Personal epistemology constitutes some sort of "handy knowledge" (Stemplewska-Żakowicz, 1996) which is naturally and automatically activated during learning processes, both inside and outside school, and although it is not always realised by the teacher themselves, it inevitably influences the course and the results of constructing one's own knowledge. However, its "naive" and commonsensical character hides some threats, the most important of which is the fact that personal pedagogy, brought by a student to his pedagogical studies as foreknowledge, becomes a specific interpretative filter for newly acquired scientific knowledge. "The more personal knowledge departs from scientific knowledge, the more scientific knowledge is perceived as unrealistic and not very useful for being applied in practice. Leaving this fact to the natural course of events results in the division of the knowledge into two categories, isolated from each other, which are formed in the student's cognitive structures. Those two categories of knowledge are scientific knowledge, which needs to be acquired to be demonstrated, in the case of which it is not proper not to have it when being a teacher, and practical, personal knowledge, which proves useful in specific situations in a school classroom" (Dudzikowa, 2015).

Such a dualism makes it difficult, if not impossible, for scientific thought to permeate the teacher's practice, which often leads to the trivialisation of educative actions and causes them to become intuitive, with the simultaneous helplessness or rather inertness of theoretical knowledge, which is referred to by Gołębniak as the "inability to go beyond one's own definitions" (cited in: Klus-Stańska, 2010, p. 72). Klus-Stańska adds: "The inertness of those definitions, their focus on the local everyday life and their dependence on specific teachers' working conditions may lead to an anti-developmental stabilisation of the system of not only the teacher's knowledge but also of the reality created by the teacher with the use of such knowledge in the classroom. This type of stabilisation stands not so much for traditionalism (although it may in fact consist in leaning towards it) but for creative inefficiency when a teacher is in two minds about a hazy need for change and a semantic closure of his own ideas" (ibidem).

In this sense, the key to releasing the teacher's innovative potential is "to realise his own hidden presumptions, tacit premises and reasons creating the deep structure of human experience" (Kwaśnica, 2003, p. 318), or, as stated by Bruner, "to deconstruct and reinterpret" those areas of personal educational theory which, even though hidden, "silently" shape our proceedings in a classroom (2006, p. 77).

Action research – pre-service teachers' conceptions of the mind and knowing

Design and methodology

The study presented here was designed as action research undertaken during the course in Early Childhood Education and Care at post-diploma degree level for in-service teachers who were seeking to change the pedagogical course of their professional career. The following research questions were formulated:

1. How do in-service teachers understand their own mind and knowing?
2. What conception of the mind do they use to explain their own learning, the process of acquiring new knowledge?
3. To what extent are they aware of their own commonsense presumptions?

Students were asked to draw their mind and explain how it works when they learn something new or solve a difficult problem. The metaphor of a machine was used as an inspiration for a projective drawing, followed by a phenomenographic interview, which was recorded and analyzed afterwards. While searching for differentiation in teachers' conceptions of the mind, several important criteria were elicited, such as:

1. Mental operations engaged in learning (functions of the mind named by a respondent) – cognitive, emotional, moral, creative, etc.
2. Internal relations between mental processes (the dynamic of cognition) – static/dynamic conception of the mind; lack of internal relations/linear relations/deep and complicated relations;
3. The results of cognition (knowledge's internal structure, the way of organising the information in the human mind) – isolated, separated data versus an integrated, internally intertwined system of knowledge.

As a result, a map of different conceptions of the mind was created, including such representations as:

1. Mind as a mystery
2. Mind as storage for data/information
3. Mind as a centre of processing information, including (i) simple, linear, and cognitive processing, and (ii) a complex, multidimensional processing model

These models will be described and illustrated with teachers' drawings in the next section.

Results

One of the most striking examples – which should be described as a "lack of conception" – is the mind represented as a mystery (Figure 1). The author of the drawing explains it as follows: "My mind as like a machine with a very complicated structure. One important stimulus is enough to light the red light in my mind. Each stimulus causes intensive work. [...]. When I learn something new my mind starts working very slowly at first, then faster and faster; the closer to the central part, the more intensive the work becomes, my mind becomes hot, burning, it cannot be touched, and finally it explodes [...]. Time causes the stimulus to dim, cool down, and it becomes less important" (MA in special education)".

Figure 1. Mind as a mystery (teacher with 17 years of experience, MA in special education)

The most important characteristics of the "mind as a mystery" model are (1) the strong feeling of internal energy, often expressed in comparison to a fire – the mind is *burning, buzzing, exploding*; and (2) the feeling of ineffectiveness (*mind becomes stuck, jammed, suspended*) and the lack of control. As a result, the respondents are not only unable to name any mental process, but they seem to have no conception of knowledge and no ability to undertake any conscious effort to make their own learning successful.

Another type of mind is the "mind as storage for data/information" (Figure 2): "My mind works in a very fast and efficient way, unfailingly. When I learn something new, my mind is accumulating new information in proper compartments. Each new topic, event, fact, data, new piece of information has to be stored in a proper place. When a problem appears which needs to be solved, or if there is a need for using the information (my knowledge or skills), this piece is easily and quickly found [...]. If I cannot find a direct solution to the problem, I try the method of 'trial and error' – sometimes my mind finds a few pieces of knowledge and puts them together to form a solution to the very difficult problem".

Figure 2. Mind as storage for data/information (teacher with 2 years of experience, MA in special education)

This is a concept of a passive, inert mind that is very static. In this vision, knowledge has an obviously external character; acquiring knowledge means collecting, remembering and restoring information, and it is conceived as an external compulsion. Memorising the new information, locating it in memory structures (segregating, arranging or separating it in a proper drawer), and retrieving the information when necessary are the key functions of this mind. The most important aspect of this activity is not to tangle the data – "paths of input" are carefully closed. Therefore the knowledge collected is cut into separate pieces, with no possibility of forming an integrated, holistic mental structure. The mind represented as a "filing cabinet" or "file binder" not only has restricted possibilities and limited control over the learning process, but also seems to be strictly cognitive – no affective, moral, or creative processes were mentioned.

The vast majority of teachers represented their mind as a machine "processing information". Figure 3 presents an example of the mind as a simple processing model: "My mind as a hard-working machine. It consists of a container where new data are collected, a conveyor

belt where the new data are moved to and processed, and then after processing and arranging in a proper order new information is moved to a warehouse where new knowledge is being stored. When I learn something new my mind works, all the elements are on the move, information is crafted, carved; the pieces which were evaluated as not important are lost, but the rest of data takes a new form. During that process, many questions or discrepancies appear which might suspend the work. When the information is ordered, crafted and arranged, it turns into new knowledge which is stored in the memory" (preschool teacher with 5 months of professional experience)".

Figure 3. Example of a "processing mind" – a simple, cognitive processing model (preschool teacher with 5 months of experience)

As we can see, the "processing mind" is richer in its areas of activity; at the same time, however, it reveals a certain stereotype based on a psychological model of solving problems. The problem seems to be an activator, inducing cognition and putting the gears into motion, but it is also a task coming from outside the system. The very process of solving the problem, of finding the solution seems quite mysterious, although it is based on "processing data", segregating information, explaining, understanding and systemising. An important role is played

here by subconscious areas of the mind (byproducts of thinking, information evaluated as not important), which – unavailable to conscious control – can disturb cognition. Although the very process of learning seems to be rather linear, the nature of knowledge underlying this model is more complex, non-linear, and constructed by the subject's mind.

A high level of variation, however, was discovered among the "processing minds" concepts: other than the linear processing, purely cognitive, problem-solving-based model, there were also examples of "complex processing" involving non-cognitive dimensions of the human mind. Here is an example of such an explanation: "My mind is a machine with a complex, but slightly chaotic structure. Sometimes very lazy and other times very creative in nature, searching but often making mistakes and losing track. There is a lot of place for feelings, emotions, colours, music, film, knowledge, memory and concentration. When I learn something new, my mind activates my senses and my whole personality [...]. When I deal with a very difficult problem, my mind needs other minds, close and friendly, which help to find the way to the world" (teacher assistant with an MA in special education, 1.5 years of professional experience).

Figure 4. An example of complex, non-linear, multidimensional processing (preschool teacher with 3 years of experience)

The model of a complex processing mind presented here not only involves non-cognitive areas of learning, e.g. emotions (the mind "*activates the motivation*", "is happy to find a right solution", etc.), sensorial experiences (the "*mind brightens up with colours*"), and moral choices (the "*mind makes decisions about what is good and what is wrong*"), but is also able to create new ideas. Interestingly, some of the respondents representing this type of mind consider social contact with other minds as highly important in constructing knowledge (unfortunately not many, however – only three examples of such statements were found in the research group). Another interesting observation is the fact that the "multidimensional processing model" was not always related to the feeling of control over one's own mind, e.g. "When I solve a very difficult problem my mind can sometimes refuse to listen to me, it can block my actions, hide the important information. It works in a straggling way as if it does not understand that it is important for me. The more nervous I become, the more blocked the mechanisms of my thinking are, and when I strive to find the resolution, my mind writes off my great cares, it seals off the possible solutions" (preschool teacher with 3 years of experience). Feelings of suspension, withdrawal, or other forms of the mind's internal resistance were also reported by many respondents.

Conclusions – in search of possibilities to change teachers' personal epistemology

The action research presented was not designed to draw general conclusions. The aim was instead to outline certain underinvestigated areas in teacher education and to open a discussion on the following questions: How can we prepare in-service teachers to undertake critical, epistemological reflections? How can we support their ability to reflect on their own concepts and hidden presumptions concerning knowledge and knowing? How can we turn these reflections into a pedagogical habit? It is difficult to find answers to such questions in the Polish pedagogical literature. However, there are discussions and innovative initiatives designed to build teachers' sensitivity to the epistemological dimension of everyday educational work that is ongoing in schools.

One of the possible solutions offered to teachers in this action research was writing as a form of dialogue with oneself (Dylak, 2013, p. 169) – such self-referred dialogue, when written down, takes

an external form, allowing the teacher to crystallize their thoughts, make them more concrete and tangible, and grasp their potential inadequacies, gaps or internal inconsistencies. Bruner describes this process as "externalisation", which "provides a record of our mental efforts, something that stays outside our mind rather than in our memory [...]. To some extent, this releases us from the always difficult task of thinking about our own thinking, leading to an identical effect. This embodies our thoughts and intentions in a form that is more accessible to reflection" (2006, p. 43). Thanks to externalisation, "the thinking process and its products are cross-cut", strengthening and complementing each other. It allows the individual to stop in the thinking process and realize what has been achieved until now. Externalisation can be used not only to reflect on one's own educational practice but also to comment on and interpret pedagogical literature, which resembles written discussions/polemics with the author (Dylak, 2013, p. 169).

Another method used to inspire epistemological reflection in authors' action research was described by Brownlee, Ferguson and Ryan (2017), who discuss the contradicting statements related to educational practice grouped in the lesson scenarios provided to students. Dialogue as a form of epistemic reflection is discussed by many authors – it provides the possibility to confront our personal theory with others' perspectives, to debate opposing views, and, as a result, to make our knowledge more precise, thorough, and recursively interpreted. The point is to ask questions that "liberate us from the feeling of self-evident truth" and allow us "to experience the genuine incertitude and suspense that make you anxious and push you to find your own answers" (Kwaśnica, 2003, p. 292). Questions that "bracket" our prior knowledge, inspiring critical reflections on its rationality and opening the space to thinking. In the postmodern, liquid reality, a teacher is no longer, as he can no longer be, "a man of answers" – he must convert himself into "a man of questions", a researcher becoming aware of the defeasibility and uncertainty of knowledge, and overthrowing the existing school reality in search of another – a qualitatively new reality, tailored to students' needs and capabilities (Adamek, 2013, p. 30).

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