

FORMATION OF THOUGHT STYLE IN ORGANIZING THE EDUCATIONAL PROCESS AND TRAINING OF MEDICAL STUDENTS

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Abstract: The purpose of the paper is to analyze thought style as a foundation for understanding the operation of scientific education. The theoretical and methodological basis of the work is formed by the concepts of development of science through paradigm shifts, philosophical analysis of thought style, and heuristic capabilities of philosophical comparativism in combination with the hermeneutic method of text interpretation as applied to the sociocultural paradigm of science. The training of a specialist in any scientific field is realized in the framework of the given thought style because the style directs the perception and determines the nature of work with the empirical material and the form of solving problematic situations. Training provides not only an increment of specialized knowledge but also a projection of a general cultural communicative orientation. Thus, the construction of how one should perceive, understand, evaluate, and apply can be viewed as the construction and implementation of an appropriate educational strategy. The concept of thought styles is one of the most successful methodologies for explaining not only the movement of science but also the implementation of education in science.

Keywords: science, philosophy of science, philosophy of education, science education, paradigm, thought style, thought collective, gestalt.

Introduction

While the members of the Vienna Circle of Logical Empiricism were interested primarily in science as a system of knowledge, the new philosophers of science, post-positivists (among which are S. Toulmin, P. Feyerabend, and T. Kuhn), problematized the relationship of science methodology with sociology, psychology, and history

of science. The emphasis on the fact of science being, first and foremost, human activity allowed psychological and sociological arguments to come to the fore in the traditional debate about the nature of science. In his turn, L. Fleck foresaw some influential ideas that are now known as the provisions of Kuhn's concept. In fact, "It was only after his death that western scientists rediscovered the theory of thought-styles. It all

happened thanks to the curiosity of an American philosopher and science historian, Thomas Samuel Kuhn” (Sak & Pawlikowski, 2012, p. 215). The uniqueness of the concept of thought styles lies in its openness. In other words, many questions concerning not only scientific knowledge but also affecting a whole range of cultural phenomena can be actualized through the prism of this concept. In particular, a recent study of Fleck’s work “Genesis and Development of a Scientific Fact” conducted by a professor of the University of São Paulo A. Martins finds a reference to the fact that critical elements of Fleck’s epistemology (“thought style”, “initiation of novices in a thought style”, “education”) may provide a significant foundation for possible research in teaching. As pointed out by Dr. Martins (2020a), there are “elements of this author’s thinking that allow to characterize the openness of his work, that is, aspects that could potentially be interesting for science education when problematized, expanded and articulated” (p. 1211).

Many modern philosophers of education (Beatty et al., 2020; Haynes, 2020; Peters et al., 2022; Pozdniakov, 2014) continue to discuss the goals and objectives of modern education, the peculiarities of the construction of the educational process, and the nature of education itself, focusing, among other things, on the search for appropriate methodologies, explanatory structures that would satisfy the solution of many problems in education. For this reason, in this study, we turn to the concept of thought style in connection with the question about the possibility of a directed construction of the educational process.

The present study thus aims to analyze thought style as a foundation for understanding the operation of scientific education.

Methods

The theoretical and methodological basis of the work is formed by Kuhn’s concept of the development of science through paradigm shifts formed in the post-positivist philosophical discourse, which emphasizes the cultural-historical, sociological, and psychological aspects of this development and which was formed in the course of post-positivist philosophical discourse; the concept of philosophical analysis of thought

style; and the heuristic capabilities of comparative analysis of the two philosophical concepts of scientific knowledge in combination with the hermeneutic method of text interpretation as applied to the sociocultural paradigm of science.

The scientific works of Kuhn and Fleck serve as a methodological prerequisite for substantiating the possibility of studying the philosophical concept of thinking styles as part of correlating the two authors’ positions. Some influence on the development of ideas contained in this study comes from the works of J. Sak, J. Pawlikowski, B. I. Pruzhinin, and K. M. Olesko.

Results

Kuhn’s relativist model of the development of science presents an attempt to move the consideration of knowledge from the methodological to the sociocultural plane. Kuhn’s concept of scientific knowledge builds upon the fundamental thesis that science, above all, is the activity of scientific communities conditioned by the specifics of their respective paradigms. Kuhn bases his theory on the idea that changes in science are intermittent. They occur in revolutions, followed by periods of relative calm. Some of the factors responsible for the occurrence of revolutions are external to science, and some can only be explained by psychology or sociology. The key term here is “paradigm” or “paradigmatic science”.

In “The Structure of Scientific Revolutions,” a 1962 book that once revolutionized the discussion of science, Kuhn (2003) writes: “‘paradigms’ ... I take to be universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners” (p. 243).

In “The Functions of Dogma in Scientific Research”, Kuhn (1963) suggests that in paradigmatic science, scholars belonging to a community of researchers act in accordance with an established set (sets) of existing rules, which are unquestioned and based on a set (sets) of established examples of scientific behavior. Manuals and teaching aids play an important role in mediating these accepted rules. Observation, seeing, thinking, describing – all are determined by this set of prescribed rules.

Kuhn’s model of scientific knowledge defines

the development of science as a change in fundamental paradigms resulting from competition between different scientific communities. Science that develops within a generally accepted paradigm Kuhn calls normal, believing it to be the most characteristic state of science. Kuhn (2003) specifies that “‘Normal science’ means research firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice” (p. 67).

The goal and purpose of normal science is not the discovery of new things, but the elucidation of phenomena relevant to the paradigm. Normal science can therefore be compared to solving puzzles. In this sense, the paradigm influences not only the explanation of current phenomena but also lays the foundation for the future discoveries of revolutionary science.

According to a renowned specialist in the philosophy of science, H. Andersen (2001), who has studied Kuhn’s work, one possible interpretation of his theory is that “we do not increase our knowledge of the real world over time; we can call ourselves lucky if we belong to the group of scientists who adhere to the latest paradigm” (p. 90).

Thus, according to the popular version of the philosopher of science Professor Kuhn, science is a human enterprise. Departing from the understanding of science as a system of knowledge changing according to the universal norms of logic and methodology, Kuhn conceptualizes scientific knowledge as the fruit of the concerted efforts of scientists, as the activity of scientific communities.

All members of a scientific community, the so-called experts, adhere to a certain thought style. This thought style forces those committed to seeing the world in a particular way (as opposed to other modes based on different thought styles). The fact that thought styles force an expert member to see the world differently is related to the Gestalt view of the world. Thus, for the adherents of the thought style *S*, there is a thought obligation (a constraint, almost a moral duty) to see the world in this way (meaning a certain image, manner), a certain mode.

Those entering a scientific community must be initiated in the thought style of the group (the community’s scientific discourse). Initiation,

during which the ruling paradigm is embedded in the mind, is an initiation into the Gestalt view of things. Kuhn’s philosophy of science thus asserts that in science there are phases of relative calm that alternate with phases of unrest and upheaval, during which a new Gestalt view is developed.

The German philosopher of science P. Hoyningen-Huene (1989) rightly points out that “the Kuhnian method of historical reconstruction of scientific knowledge largely shaped the trend that emerged in science at the end of the 20th century” (p. 510). To this we can add that, having brought to light the problems of scientific methodology in its relation to sociology, psychology, and the history of science, Kuhn’s method remains relevant more than a quarter of a century later. The question we are asking may be formulated as who or what served as the inspiration for Professor Kuhn himself, who in his time declared a historiographical revolution in science.

Among the thinkers who had a significant influence on his worldview, along with A. Koyre (1939), E. Meyerson (1930), and B. L. Whorf (1956), Kuhn (1999) especially singles out the Polish microbiologist and epistemologist Fleck. Kuhn admits to the fact that Fleck anticipated many of his own ideas. As testified by his biographers, notably the German sociologist T. Schnelle (Cohen & Schnelle, 1986, p. 468), Fleck, while still studying medicine at the University of Lviv, became interested in philosophy and after graduation continued to dedicate his time to philosophy, sociology, and the history of science. In 1935/36, Fleck published his major philosophical monograph “Genesis and Development of a Scientific Fact” written in German and translated into English almost 40 years later (Fleck, 1999). Fleck’s work is a parallel presentation of two case studies. In chapters 1 and 3, Fleck describes the history of sexually transmitted diseases. In chapters 2 and 4, we can find Fleck’s sociological account of what happened epistemologically. The latter is of interest in the context of the current study.

Science can never get rid of its past. Fleck finds ample evidence for this hypothesis in the discussion of the concept of venereal disease. The past lives on in concepts, technical terms, language, and institutions. Fleck argues that many claims of scientific fact can be traced back to pre-scientific proto-ideas (Urdeeen) (Flecksi-kon, n.d.), to the archetypal structures which are

the formative principles of thinking and seeing. This brings to mind an analogy with I. Kant's cognitive a priori.

Kant made us realize that while we learn about nature from experience, we must learn something before experiencing something. According to Kant, a priori synthetic knowledge is constant and plays an active role in cognition. Our picture of the world is shaped not only by things in themselves, but also by our forms of perception and categories of thought, and we can never know how or when this picture resembles something that exists independently of our cognitive actions.

Fleck does not share Kant's epistemology in general but does refer to it when looking for confirmation of his own claims. In particular, he accepts Kant's thesis on the active role of the cognitive a priori. An empty mind will neither perceive nor think. Thus, before the mind begins to experience, and on the basis of experience begins to think, it must be filled with some initial knowledge.

Fleck reasons that philosophical principles, once established, tend to ignore change. This means that a closed conceptual system, once fully formed, is asserted and will stubbornly resist everything that contradicts its meaning.

Fleck notes that the attitudes of a certain group of professionals towards controversial views are characterized by the following features: 1) What does not fit into the system will be missed; 2) It will not be mentioned, even if it has been noticed; 3) If it is repeated, much effort will be spent to prove that it does not contradict the system; 4) It will be described in terms of an established theory.

Thus, there is a general conservative attitude among members of the specialist group and, consequently, in the development of the theory during the calm phase (Fleck calls it the phase of "classicality" – "Klassizität"), during which problems can be solved without changing the pervasive theory, and then in the post-classical phase, during which problems accumulate and can no longer be solved.

All knowledge is socially conditioned, states Fleck. Therefore, we must never claim that X knows fact F, but rather that X knows fact F based on thought style S as a member of thought collective C.

Fleck (1999) defines "thought collective" ("Denkkollektiv") as "a community of persons mutually exchanging ideas or maintaining intellectual interaction" (p. 64). The thought collective is a vehicle for the field of thought, the transport of a particular set (fund) of knowledge and culture (García Sánchez, 2021). The thought collective can be scientific or non-scientific. It is made up of individuals, but it is an integral whole with inherent synergy and characteristic dynamics.

The deeper a scholar's knowledge in his field of specialization, the more dependent they will be on their thought style, and the weaker will be their ability to think independently and in different ways. Contrary to the notion of basic terms, Fleck believes that descriptions purely of what is observed (rein Beobachteten) are always unclear. Ambiguity even proves the quality and originality of essence perception (knowledge). "This is the case with all really valuable experiments. They are all of them uncertain, incomplete, and unique" (Fleck, 1999, p. 112). Once they become repeatable, clear, and precise, they are only good for demonstration.

As a philosopher of medicine, Fleck relativizes the nature of disease. He applied medical reasoning to demonstrate the relativity of truth in science, seeking to show that the definition of disease is arbitrary and depends solely on the thought style in which it is studied (Solska, 2015; Shepetiak & Shepetiak, 2020). As an epistemologist, Fleck proposes that cognition should be viewed as a function of three components. It is the relationship between an individual subject, a particular object, and a given thought community. This – the realization of a cognitive (and indeed social) act – only 'works' when a particular thought style originating from a given community is used.

Fleck (1999) defines "thought style" ("Denkstil") as

the readiness for directed perception, with corresponding mental and objective assimilation of what has been so perceived. It is characterized by common features in the problems of interest to a thought collective, by the judgment which the thought collective considers evident. (p. 150).

When a group of people speak about

something important, they start talking about things that would not occur to them if they were alone, and that they would not talk about if they were in another group of people. There emerges a style of thought characteristic of this group. (Fleck, 1999, p. 153).

When a thought style developed and used by the collective becomes sufficiently sophisticated, the collective breaks up into a small esoteric circle – a group of initiated specialists, and a larger esoteric circle – for all those who are affected by the style but do not play an active part in its formation. Exoteric circles only have access to the right style of thinking through esoteric circles, for example, by listening to clergy preaching or reading popular literature written by scientists. However, all members of exoteric circles certainly create public opinion that justifies the efforts of specialists and gives them the incentive to continue their work.

Fleck thus creates a rather inquisitive architecture of the thought community. Many cognitive psychologists, epistemologists, and philosophers who have formed the post-positivist tradition in the philosophy of science are at least following in the wake of this interesting idea.

It seems indisputable that the popular version of Kuhn's paradigmography shows much in common with Fleck's work. Both authors prefer to focus on an analysis of the "subjective" side of scientific activity, leading essentially to the conclusion that the rationality of science is not reducible to its logicity. The rationality of science is somehow correlated with its psychological and socio-cultural certainty. Our task, according to Kuhn, is to clarify this correlation. "Most part and perhaps even the entirety of scientific knowledge is conditioned by historical, psychological, and sociological factors, and these must be taken into account when trying to explain this content" (Fleck, 1999, p. 49).

At the time Fleck wrote his famous work, European philosophy of science was heavily influenced by the ideas of the Vienna Circle, united by the program of logical positivism. Comprehension of the phenomenon of thought community was thus a step ahead of the evolution of the Western philosophy of science by almost a quarter of a century. The notions of thought style, thought collective, and lines of collective thought

developed by Fleck and Gestalt interpretations of the theory of the burdenedness of experience laid the foundation for a research program in the philosophy of science that differed from logical positivism in its focus on the personal element of scientific discovery. It can be said that the concepts of thought style and thought collective, as developed by Fleck, were the schemata of the concepts of scientific community and paradigm by Kuhn.

Discussing the fact that individuals with different thought styles do not fully understand each other when they meet, Fleck repeatedly uses the term "incommensurability". At the core of it is the idea that there are no invariants in the historical development of science. When discussing the so-called "active" and "passive" elements of the thought style, apparently principles, proto-ideas, and their historically and culturally determined interpretations, Fleck observes that science is distinguished by attempting to add as many passive elements to its system as possible. Thus not only proto-ideas, prerequisites, but also passive elements can serve as a starting point for the creation of the new. Fleck does not delve into this idea. As the Polish scientists Sak and Pawlikowski (2012) note in their study, "we are again to lament that he did not develop the idea that could have aided in understanding the mechanism of those transformations that Kuhn later called scientific revolutions" (p. 217).

The style of scientific thought is a complex perceptual and epistemic structure responsible for the way scientists act and perceive in a particular fashion. The style establishes the internal order and the organization of researchers. Ideas and norms and values, which are the substantive elements of the thought style, condition the way the scientific community functions.

Thought style defines a common space of worldview preferences, methodological tools, and language culture. This space is at the same time the space of communication between members of the scientific community based on the commonality of ideological orientations, categorical and conceptual apparatuses, values and goals. Within this space they understand each other and exercise a kind of identification of the cognitive and axiological field, by

which they contrast themselves with other style groups (Khadzharov, 2010, p. 88).

In a nutshell, the thought style solves the most important ideological and cultural task: it represents itself as a system of priority values, predictions, and ideological reference points, through which the image of the world, the cognitive model of the world, is formed. The system of cognitive values is defined in accordance with this model.

The thought style solves an ideological problem under which the scientific community makes some effort to defend and promote the values to which they adhere. Other cognitive and normative preferences that are inconsistent with their adopted value system are regarded as extra-scientific.

As a cultural, philosophical, and ideological system of dominant values, the style of thought integrates scientists into a single scientific community, thereby defining a common horizon of meaning and giving a character of commonality to their intellectual work.

Thus, through the introduction to the philosophy of science and the active development of conceptualizations that are now known as thinking style, paradigm, scientific community, or thought collective, a largely social constructionist view of scientific knowledge was prepared. It became possible to justify as a key element of any model of the scientific cognitive process a style of thinking (a way of determining what can be thought and perceived), inseparable from its bearer – the collective communicator.

The methodology of Kuhn is certainly more widely known than the corresponding views of Fleck and includes interpretations that take on an even greater significance when juxtaposed with Fleck's ideas.

Fleck took as the subject of his analysis of scientific knowledge the notions of thinking collective and thought style and, by defining the latter also as previous knowledge produced in a particular way, under particular conditions, he raised the question not only of the need to study the genesis process of previous knowledge (which is the only way to access it) but also of the need to concentrate on the conditions of this genesis, the space of formation of conditions that in turn facilitate the formation of thought style. In the Fleckian concept, therefore, the place of hon-

or in the link between the communicator and thought style is held by the educational platform, which creates the conditions for communication and constitutes the habits of thought or thought style that are formed.

In the concept of knowledge created by Fleck “science education, including science popularization, was the key institutional site for creating conditions conducive to this kind of intersubjective communication” (Olesko, 2020, p. 52). This concept emphasizes that science education can and should demonstrate how science works, including in the social sphere.

The training of a specialist in any scientific field is carried out within a given style of thought, as the style (or discourse) guides perception, and determines the nature of handling the empirical material, and the form of resolution of problematic situations. The style, however, also shapes the general position of the specialist with regard to the culture of knowledge and their interpretation of this culture. Thus, at all its stages, training provides not only an increment of specialized knowledge but also a projection of a general cultural communicative orientation. As Fleck convincingly demonstrated with his analysis of the thought style, this concept defines the formation of the scientist, the specialist in a fairly broad worldview sense, but, more importantly, this concept is itself a determinable one. This means that the construction of the method of perception, understanding, evaluating, and using can be considered as the construction and realization of the respective educational strategy.

An interesting example is given by the American historian of science Olesko (2020, p. 56), in her study of the debate on medical pedagogy that broke out back in 1928. The debate was initiated by H. A. Bethe, a physiologist and doctor at Frankfurt University, and was concerned with clarifying the question of whether physiology or anatomy should be the scientific basis of medical training. Bethe himself argued in favor of physiology because too much emphasis on anatomy loaded students with excessive detail and accustomed them to pointless mechanical rote learning (a skill more useful to scientists than doctors). Physiology, with its strong physical and chemical basis, has more relevance to medical practice because, unlike anatomy, it is a dynamic field of research. The ensuing criticism of the anatomical tradition forced Bethe to finally acknowledge

that each side of the argument was thinking in different structures, which by definition made it difficult to choose between the morphological or the functional approach.

According to Professor Olesko, this exchange on medical pedagogy, to which Fleck drew attention at the time, provided him with compelling evidence of how thought style works and how its restraint on thinking impedes communication between adherents of different communication styles.

Fleck, a philosopher and historian of medicine, being himself part of the professional medical community, was well aware that the field of medical knowledge was one of the most conservative, where the restraining but necessary role of a given canon of thought is most evident. However, medical thinking, in his view, cannot be interpreted in a purely positivist, logical way. The evaluation of real cases occurring in the real world, Fleck argues, requires the development of a kind of specific intuition which, as a way of constructing a canon of thought, would allow the specialist (particularly the medic) to change their perspective in response to the course of problems or non-standard situations that arise and to deviate from constant thought patterns. Thus, central to Fleck's analysis is not only and not so much the recognition of the incommensurability of different thought styles, and their consequent known limitations, as the exploration of the possibility of influencing the formation of thought style components to increase perceptual flexibility. Since this concerns the purposeful formation of a thought style that operates in a broad educational environment, one of the most important problems of philosophical analysis of science is that of education.

Fleck, drawing on his professional interests, derived his conclusions from a study of the activities of the medical community and the style of medical thought. Yet these interpretations can also be considered in the broadest context, implying the formation and existence of a thought style in any intellectual environment.

Thus, Fleck attributed a central role in maintaining the style of thought and the thought collective to science education. He believed that the use of special methods of teaching also fulfills the upbringing purpose of training specialists and scientists. The emerging style of thought (scientific discourse) reveals not only cognitive but

also moral and axiological components in its structure. Fleck also believes that the educational space not only provides the acquisition of knowledge and specialized skills but also prepares the positioning of oneself in the world. In this way, the social responsibility of education is established as its most important priority.

Fleck proceeded from the position that there cannot be styleless observation and styleless perception. The restraining, limiting role of a certain style of thought manifests itself in the fact that, conventionally speaking, vision is accustomed to seeing some forms, while not seeing others. An education that accumulates cognitive and worldview traditions provides readiness for stylized thinking. Education turns out to be capable of changing the personality. Thus, the responsibility for the student's ability to learn and, more importantly, to discern themselves, to form the thought-stylized attitude that is most adequate, and thus sufficiently flexible and able to minimize the dogmatic element, rests with education.

Discussion

Although the conceptual structure of the famous works of Kuhn ("The Structure of Scientific Revolutions") and Fleck ("Genesis and Development of a Scientific Fact") has been discussed and analyzed extensively, there continue to appear works that explore not only the reciprocal relationship of these concepts but also the possibilities of using the interpretations offered by the scholars in discussions of a wide variety of philosophical issues.

Kuhn's paradigms, same as Fleck's thought styles, successfully explain the mechanisms of the evolution of scientific knowledge (in Fleck's case, especially medical knowledge). However, based on some of the studies we have been interested in (Ciesielska & Jarnicki, 2021; Martins, 2020a, 2020b; Olesko, 2020; Peña-Guzmán, 2020; Sankey, 2021), we can reasonably argue that interest in these concepts is not limited to the traditional topics of philosophy and the methodology of science. For example, Doctor of History and Philosophy of Science, professor at the National University of Tres de Febrero (Argentina), C. Lorenzano in his work "Philosophy and History of Science in South America" mentions that Kuhn, in explaining the purpose of the paradigm,

also touches on the question of learning science or teaching science and the manipulative capacity of the paradigmatic structure that emerges in this process. In this sense, the paradigm turns out to be “not fully explained by Kuhn and analyzed only out of the needs of the philosophy of science” (Lorenzano, 2004, p. 95). Fleck's concept of thought styles, which many (including Dr. Lorenzano) see as a kind of introduction to the epistemology of Kuhn, expands the field of philosophical analysis of science. Through this concept, we come to such questions as the importance of the adequate training of future professionals in science, and thus of an adequately constructed educational strategy, questions about the importance of a historical study of science education to ensure the future credibility of science in the social environment.

Now, answering the question on the comparability of the French epistemological school and the concept of Kuhn and Fleck, we can state the following. First, in both cases, science is presented as a community activity, a certain communicative act. Second, this activity is subject to change and criticism. Fourth, the concepts of both schools refer to a style of scientific thought, otherwise known as scientific discourse, formed by the broadly communicative actions of the scientific community, which imply addressing the socio-cultural environment with its wide range of possibilities.

The History and Philosophy of Science course for medical students has traditionally included an overview of the leading methodological concepts, especially those that have produced a social constructionist view of scientific knowledge. Introduction to some of the positions substantiated at different times by historians, philosophers of science, and philosophers of education suggests that the concept of thought styles is perhaps one of the most successful methodologies for explaining not only the movement of science but also the implementation of education in science. “Education is a blending of ideas, a balanced tension between academic content, the student as a person, and social behavior” (Parhusip, 2020, p. 22). The concept of thought style, which reflects and equally constitutes all these aspects of the educational space, can be viewed as an essential part of educational methodology.

Similarities between the positions of Kuhn and Fleck are evident. Both worked on similar

conceptualizations, now known as paradigm and thought style (or scientific discourse in French historical epistemology). Yet Fleck himself always believed that his theory of cognition was not just a philosophy of science. Thought styles are not limited to science – all thought occurs in languages, in groups, in the languages of groups, be they scientific, artistic, journalistic, or other. Fleck was open to all these manifestations of thought and styles of thought and tried to integrate them into his theory. He tried to show that his theory was valid in general and specifically for science. Kuhn, on the other hand, by concentrating on science, and there mainly on physics, is in some ways limiting his field of study.

As noted many times before, the Kuhnian paradigm is to a certain extent determined by the influence of Fleck's concept. However, in the process of our consideration and comparison of the concepts, it is difficult not to agree with the opinion of the famous Soviet and Russian philosopher Pruzhinin that the concept of style of scientific thought is more productive for modern philosophical and methodological research than paradigm.

The lack of semantic integrity in the scientific inquiry was compensated for within the notion of the paradigm of scientific inquiry by the sociologicalization of mechanisms for achieving scientific consensus. This led to the relativization of the criteria of objectivity of scientific cognition. The notion of the style of scientific thought holds the idea of semantic integrity of the history of cognition realized in its style as a specific characteristic of the language of different periods of scientific development, as well as the idea of multivariance, diversity of expression of knowledge about the same fragment of the world in the scientific language (Pruzhinin, 2011, p. 65).

Conclusion

Both Fleck and later Kuhn followed the path of explicating the cultural-historical, sociological, and psychological factors of scientific cognition. The experiences of these scholars, which have

demonstrated the possibilities of relating different subfields within academic philosophy, have been very productive both for their mutual development and for a significant expansion of the field of philosophical inquiry.

The theme of intersubjective communication, which emerged out of reflection on the mechanisms of development of scientific knowledge, provided a legitimate justification for the question of the conditions conducive to this kind of communication, in other words, the question of the educational environment. Fleck justifiably assigned the key role to science education in shaping the final image of science, the adequate assessment of its possibilities, and the consequences of the implementation of its results in social practice. Developed within the framework of academic philosophy, the philosophy of education has successfully synthesized the experience of historical philosophy and the possibilities of its application to reflection on the nature of the educational process. Philosophy of education is a philosophically disciplined method of thought, proven techniques of analysis, and argumentation designed to deal effectively with educational problems. Thinking about the philosophy of education in a broadly teleological way, this methodological corpus aims to justify the value of educational efforts and to bring the educational process into harmony with other social processes.

References

- Andersen, H. (2001). *On Kuhn*. Belmont, CA: Wadsworth.
- Beatty, J. E., Leigh, J. S. A., & Lund Dean, K. (2020). Republication of: Philosophy rediscovered: Exploring the connections between teaching philosophies, educational philosophies, and philosophy. *Journal of Management Education*, 44(5), 543-559. <https://doi.org/10.1177/1052562920912915>
- Ciesielska, M., & Jamicki, P. (2021). *Ludwik Fleck - Mikrobiolog i filozof* (Ludwik Fleck - Microbiologist and philosopher, in Polish). Warsaw: Publishing House of the Warsaw University of Technology.
- Cohen, R. S., & Schnelle, T. (1986). *Cognition and fact. Materials on Ludwik Fleck*. Boston, MA: D. Reidel Publishing Company.
- Fleck, L. (1999). *Vozniknovenie i razvitie nauchnogo fakta: Vvedenie v teoriyu stilia myshleniia i myslitel'nogo kollektiva* (Genesis and development of a scientific fact: Introduction to the theory of thought style and thought collective, in Russian). Moscow: Ideya-Press, Dom intellektual'noy knigi.
- Flecksikon. (n.d.). *Fleck Glossar Version 0.2/Stand 4.9.06/*. Retrieved February 25, 2023, from http://ludwik-fleck-kreis.org/uploadfiles/documents/1909_015340_Flecksikon
- García Sánchez, C. (2021). Ludwik Fleck: La teoría de los estilos de pensamiento y de los colectivos de pensamiento (Ludwik Fleck: The theory of thinking style and thinking collective, in Spanish). *Revista Colombiana De Filosofía De La Ciencia*, 20(41), 147-167. <https://doi.org/10.18270/rcfc.v20i41.1985>
- Haynes, B. (2020). Can creativity be taught? *Educational Philosophy and Theory*, 52(1), 34-44. <http://dx.doi.org/10.1080/00131857.2019.1594194>
- Hoyningen-Huene, P. (1989). Von Wissenschaftsentwicklung und Wirklichkeit in der Theorie Thomas S. Kuhns (Of science development and reality in Thomas S. Kuhn's theory, in German). *Deutsche Zeitschrift für Philosophie*, 37(6), 510-511.
- Khadzharov, M. Kh. (2010). *Stil' nauchnogo myshleniya v sotsiologii znaniya* (Style of scientific thinking in the sociology of knowledge, in Russian). In S. F. Martynovich (Ed.), *Filosofiya nauki v informatsionnom obshchestve: Aktual'nye problemy. Materialy Pervoi mezhevuzovskoi nauchnoi konferentsii* (Philosophy of science in the information society: Actual problems. Proceedings of the First interuniversity scientific conference, in Russian) (pp. 87-89). Saratov: Izdatel'stvo "Saratovskiy istochnik".
- Koyre, A. (1939). *Etudes Galileennes*. Paris: Hermann & Cie.
- Kuhn, T. (1999). *Predislovie k angliiskomu pe-*

- revodu (Preface to the English translation, in Russian). In L. Fleck, *Vozniknovenie i razvitie nauchnogo fakta: Vvedenie v teoriyu stilya myshleniya i myslitel'nogo kollektiva* (Genesis and development of a scientific fact: Introduction to the theory of thought style and thought collective, in Russian) (pp. 20-21). Moscow: Ideya-Press, Dom intellektual'noy knigi.
- Kuhn, Th. S. (1963). The functions of dogma in scientific research. In A. C. Crombie (Ed.), *Scientific change: Symposium on the history of science, University of Oxford, 9-15 July 1961* (pp. 347-369). London: Heinemann.
- Kuhn, Th. S. (2003). *Struktura nauchnykh revoliutsii* (The structure of scientific revolutions, in Russian). Moscow: OOO "Izdatel'stvo ACT".
- Lorenzano, C. (2004). Los ancestros de Thomas Kuhn (Homenaje a Ludwik Fleck) (The ancestors of Thomas Kuhn (Homage to Ludwik Fleck), in Spanish). In R. A. Martins, L. A. C. P. Martins, C. C. Silva, & J. M. H. Ferreira (Eds.), *Filosofia e historia da ciencia no Cone Sul: 3º Encontro* (pp. 91-101). Campinas: AFHIC.
- Martins, A. F. P. (2020a). A obra aberta de Ludwik Fleck (Ludwik Fleck's open work, in Portuguese). *Brazilian Journal of Research in Science Education*, 20, 1197-1226. <http://dx.doi.org/10.2897-6/1984-2686rbpec2020u11971226>
- Martins, A. F. P. (2020b). Terraplanismo, Ludwik Fleck e o mito de Prometeu (Flat-Earthism, Ludwik Fleck and the Myth of Prometheus, in Portuguese). *Caderno Brasileiro de Ensino de Física Journal*, 37(3), 1193-1216. <http://dx.doi.org/10.5007/2175-7941.2020v37n3-p1193>
- Meyerson, É. (1930). *Identität und Wirklichkeit* (Identity and reality, in German). Leipzig: Akad. Verlagsgesellschaft.
- Olesko, K. M. (2020). Ludwik Fleck, Alfred Schutz, and trust in science: The public responsibility of science education in challenging times. *HoST - Journal of History of Science and Technology*, 14(2), 50-72.
- Parhusip, A. (2020). Modern educational philosophies. In *Proceedings of the 1st International conference on education, society, economy, humanity and environment (ICESHE 2019)* (pp. 22-24). Atlantis Press. <http://dx.doi.org/10.2991/assehr.k.200311.005>
- Peña-Guzmán, D. M. (2020). French historical epistemology: Discourse, concepts, and the norms of rationality. *Studies in History and Philosophy of Science*, 79, 68-76. <https://doi.org/10.1016/j.shpsa.2019.01.006>
- Peters, M., Neilson, D., & Jackson, L. (2022). Post-marxism, humanism and (post)-structuralism: Educational philosophy and theory. *Educational Philosophy and Theory*, 54(14), 2331-2340. <http://dx.doi.org/10.1080/00131857.2020.1824783>
- Pozdniakov, A. A. (2014). *Stil' nauchnogo myshleniya: Epokhnaya ili distsiplinarnaya kontseptsiya?* (A style of scientific thinking: An epochal or a disciplinary concept?, in Russian). *Epistemology & Philosophy of Science*, 39(1), 191-210.
- Pruzhinin, B. I. (2011). "Stil' nauchnogo myshleniya" v otechestvennoi filosofii nauki ("Style of scientific thought" in Russian philosophy of science, in Russian). *Problems of Philosophy*, 6, 64-74.
- Sak, J., & Pawlikowski, J. (2012). Medicine and thought-styles: On the 50th anniversary of the death of Ludwik Fleck (1896-1961). *The Israel Medical Association Journal*, 14(4), 214-218.
- Sankey, H. (2021). Realism and the epistemic objectivity of science. *Kriterion – Journal of Philosophy*, 35(1), 5-20. <http://dx.doi.org/10.1515/krt-2021-0002>
- Shepetiak, O., & Shepetiak, O. (2020). Ludwik Fleck: A philosopher forgotten in Ukraine. *Idei*, 1(15)-2(16), 18-28.
- Solska, E. (2015). Ludwik Fleck: A message to start a new discourse. *Current Issues in Pharmacy and Medical Sciences*, 28(1), 60-62.
- Whorf, B. L. (1956). *Language, thought and reality*. New York: John Wiley and Sons.