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Cause and Effect Relations of the Competences Forming Process for Innovative Activity of Future Primary School Teachers

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Abstract

Today it is relevant to theoretically and experimentally substantiate the cause and effect relations in the context of forming competencies for innovative activity of all students, including future primary school teachers. The formation of professional competencies, in general and the formation of pedagogical competencies of future primary school teachers, in particular is a long path, which is influenced by many factors. Identification of these causes contributes to the proper organization of the educational environment and introduction of technology for the formation of professional competencies. Even Aristotle asserted that “science that studies causes is more capable to teach, because those who teach indicate the causes of each thing Arche and causes most of all deserve cognition, because through them and on their basis everything else is cognized, but not through what is subordinated to them”.

Our work, which opens up new horizons of research, presents new phenomena, relationships and patterns that previously remained uncovered in the professional training of future primary school teachers. The first stage of the experiment involved more than 250 university applicants and students from the Chuvash Republic and the Republic of Tatarstan.

Modern pedagogical activity is characterized by active implementation of innovations at work. The introduction of innovations is always associated with the creative transformative activity of teachers, in other words with the implementation of acquired competencies at the university. In today’s reality, teachers actively respond to the challenges of sociocultural reality and, without rejecting existing educational traditions, they introduce fundamental innovations into education, training and development of students’ personality. Consequently, in the innovation processes, not only the pedagogical activity itself, the inherent in it means and mechanisms, but also its goals and value orientations are substantially restructured.

The analysis of existing scientific and pedagogical research studies and an ascertaining experiment demonstrated that the contradictions existing in the education system determine the effect as causes - the goal: the need to have teachers in the modern education system with formed competences for innovation. It is here that cause and effect relations arise: the relationship between the goal, the means and the “education material”, and the “product of education”, which are a special, most complex form of determination. An important role here is played by all components forming competences for the innovative activity of primary school teachers. For example, once having arisen, the purpose of vocational training as a result itself becomes the basis of the activity of the educational system, as a law, defining the method and nature of activity of future teachers. However, the goal itself does not accidentally arise. The goal also has a causation of occurrence. On the other hand, the end result, the readiness of primary school teachers for the innovative activity, is also influenced by the “first cause” - the applicant’s choice of his or her future teaching profession, which at the same time acts as a consequence of the influence of many reasons and leads to the conclusion, namely the profession must be chosen due to dedication.

The study proves that the given “first cause” has a direct impact on the process and levels of formation of readiness of future primary school teachers on the components of readiness for innovative activity, such as: motivational, technological, organizational, cognitive components.

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Consideration of the “first cause” in vocational education allows technologizing the preparation of future teachers for innovative activity, avoiding the reasons for the lack of mastery of academic disciplines and compulsory teaching materials; building correctly a personality-oriented trajectory of the professional development of each student.

Keywords: cause; effect; relations; process; formation; competences; innovations; creativity; innovative activity; future teachers.

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Introduction

The modern pedagogical activity mainly consists of the active implementation of some innovations at work. The introduction of innovations is always associated with the creative transformative activity of teachers, i.e. with the implementation of acquired competencies at university. As noted above, in today’s reality, teachers actively respond to the challenges of sociocultural reality and, without rejecting existing educational traditions, introduce fundamental innovations in the education, training and development of students’ personality.

Considering the structure of innovative processes in teaching, it is necessary to distinguish the following creative stages:

- detection and perception of relevant didactic, educational, methodological and other materials (this is “processing” of the perceived material based on the acquired competencies, which should go to the next stage of the creative process - competence, which provides a professional creative approach to the teacher’s activity);
- emergence of the idea of introducing innovations into teaching;
- development of the idea in the applied aspect;
- justification of the implementation (arguments for achieving a positive effect compared with the existing state, experimental verification);
- practical implementation (introduction);
- study and evaluation of the implementation results;
- further development of the topic of innovations.

The above-mentioned stages of pedagogical creativity are often carried out in causal relationships simultaneously, some of them may fall out at all (which leads in many cases to a consequence, namely negative results), other intermediate stages are also possible. However, the presence of all stages is not a guarantee against errors, since it is still necessary to effectively implement any of them. In light of this, each causal link is essential in the process of forming competences for the innovative activity of future teachers.

It follows from the above that there is a whole chain of professional actions that always lead to an effect - pedagogical creativity: from the goal of forming pedagogical, social competencies to competence

and pedagogical creativity. Such cause and effect relations coexist in this chain which trigger a complex educational system-environment, and the result of the educational system is a “competent product of training and education” - a modern teacher due to his or her professional qualities who meets the requirements of the modern educational policy.

In modern universities, the aim of forming a competent teacher defines a professional standard, which presents the full range of necessary professional competencies for future teacher. In the process of forming competences, the future teacher has cause and effect relations: the relationship of purpose, means, and “education material” and “product of education”, which are a special, most complex form of determination.

Therefore, it is possible to talk about the most diverse forms of relation between causes and effects, for example, goals and means, participants of the pedagogical process of “production”, “finished product” - competence to future creative pedagogical activity of a teacher” fixing their deep interrelations and interconnections. In essence, the classical scheme $FC \rightarrow C^* \rightarrow C^{**} \rightarrow C^{***} \rightarrow C^{****} \rightarrow C$ arises, where each consequence becomes the cause of a series of subsequent consequences leading to the final consequence under investigation (FC – “first cause”, C - consequence).

In the first case, time and the need to have a “product of high quality” determine the goals, and we are dealing with a process of goal setting, where technology is needed. In the second case, the goal directs the analysis, selection and creation of conditions and means, and we are talking about expedient activity, i.e. about technological effectiveness of this process. In the third case the conditions, means and “participants of the production process” act as a way to solve a specific type of tasks, becoming the goal (subject) of special study and learning. They are studied as specific academic disciplines in high school conditions in the form of training and education techniques. There is also workability. In the fourth case, “the complete product” as a product of achieving the goal-cause is included in further activities as its means, etc. That is why in the conditions of modern technological civilization with its familiar spirit of techno and economocentrism we use the term “technology”.

Purpose and objectives of the study

The research objective is to identify and provide a holistic reflection of the natural and significant relationships in the pedagogical reality involved in the process of forming competences of future primary school teachers for innovative activity; to prove that in the context of the regular relationships of the existing causes-factors in the education system it is necessary to take into account the causes-factors (according to the theory of Kaoru Ishikawa): first order (“big bones”); second order (“medium bones”), third order (“small bones”), which allow to identify the consequence of causal relationships - the cause (effect) of choosing by an applicant the profession of a primary school teacher as a future profession.

Literature review

The problems of preparing future specialists for innovative activity are examined in the Russian scientific and pedagogical literature by psychologists and educators at different levels and directions.

Psychological problems of readiness for activity of future specialists are considered in the works of Dyachenko & Kandybovich (1976), Kruchinina (2003), Ponomareva (2011) and others. The scholars in their works emphasize the personal and functional approaches to the formation of readiness for activity, and readiness is defined as a complex mental education, the manifestation of individual personality traits and their implementation in the process of professional activity.

Studying the process of formation of future engineers for innovative activity in the educational process of a higher educational institution, Ponomareva determines the main structural components of readiness for innovative activity: organizational, managerial, structural, informative and subject.

In their studies, Yakovlev (1975), Podymova (1997), Slastenin (2002), Isaev (2002), Prishchepa (2010), Lagunova & Voropaeva (2013), Voropaeva (2014) identified the components of future teachers' readiness for innovative activity. These are motivational, pedagogical, methodical, psychological, cognitive, creative, informational, educational, technological, reflective, volitional, social and other types of readiness.

In addition, Voropaeva specified initial, low, medium and high levels of readiness of future teachers for innovative activity. These levels correspond to modern times, because students' motivation for gaining competences in order to be ready for innovative activity is very different.

The authors began to investigate this problem quite a long time ago. We consider the formation of future teachers' readiness for innovations through the prism of their readiness for pedagogical creativity. In our opinion, in the condition of a complete educational process at a higher education institution the formation of future teachers' readiness for pedagogical creativity, and therefore for the introduction of innovations, is a permanent process that moves from a student's elementary view of the essence and character of pedagogical creativity to a controlled, self-regulating process, where the subject of creativity, endowed with a unique experience, develops as an individual.

The main indicators of forming the future teachers' readiness for innovations, capable of professional and creative activity: the future teacher's motivation for professional and creative activity based on self-awareness of creative individuality and the need for self-realization based on deep theoretical and practical knowledge; readiness to solve communicative problems with pupils and colleagues at elementary school; the ability to detect contradictions in pedagogical processes and the desire to resolve them; possession of scientific knowledge and the future teacher's specific pedagogical skills according to the methods of education and training, professional independence, non-standard thinking, ability to see the causal external and internal connections between pedagogical phenomena; manifestation of personal-individual and professional qualities in the course of pedagogical practice of unity; the presence of a pedagogical ideal, emotionality; the presence of the qualities of a reflexive evaluation of the own activity and its results in the future teacher; skills to determine the perspective of their professional growth; knowing the logic of the development of a holistic pedagogical process and the dynamics of the "teacher-pupil" relationship; the desire to bring the started work to the end; existence of a need for self-improvement, self-education. In brief, readiness for creativity is, first of all, the presence of formed competencies, as well as pedagogical culture in their implementation. On the basis of these indicators, the levels of creativity and innovations realized in the course of pedagogical activity are determined.

The authors presented the main provisions of the theory of cause and effect relations in the phenomena of nature and society. Answering the question: "What is the reason for the success or failures of higher education pedagogy?", they write that "A search for answer to the question posed will inevitably lead us to the need to discover appropriate, repetitive causal relations in the process of training and education, to determine the rules governing the structure, content, methods and technology of the organization and implementation of education and training". Only at this level, according to the researchers, at the level of discovery of patterns in pedagogical phenomena, we can prove this or that pedagogical phenomenon, the situation and give a thorough causal explanation of the given fact and its initial causal condition of occurrence.

Analysis of foreign studies

We will not be mistaken if we say that the ancient Greek philosopher Aristotle (384–322 BC) laid the foundations of the methodology for the study of cause and effect relations (384–322 BC). He made a significant contribution to the development of many sciences, including the development of the theory of cause and effect relations. In his work “Metaphysics”, the philosopher developed a terminological system of the theory of analysis of cause and effect relations in nature and society. He believed that each phenomenon can have several causes (aitia, aition), and phenomena can be different reasons for each other; the presence and absence of the same cause can be the cause of opposite events. The philosopher stated: “It is absolutely obvious that it is necessary to acquire knowledge about the first causes ... And to search for this reason means to search for some other beginning, [namely], as we would say, from where the movement started (Aristotle, p. 70–72). The philosopher paid special attention to the need to identify and justify the goal in the causal chain of events and phenomena.

We find the conceptual development of the theory of cause and effect relations in the work of John Dewey “Reconstruction in Philosophy” (1948). The author believed that what has particular importance of the ultimate and formal causes belongs to the category of the highest causes, while the acting causes occupy the lowest level. According to Dewey (2003, p. 53), the “acting cause” determines movement and represents only external change, since it accidentally gives a kind of impetus to an immature, imperfect creation and serves as the beginning of its movement to an improved or complete form.

Another scientist, Karl Popper, in *The Introduction to the Logic of Science* (1959), approaches the development of the theory of cause and effect relations from the point of view of the physics science. He believed that from the point of view of physics, the expression “causal explanation” can be implemented through existing laws, that is, to give a causal explanation of some event means to deduce the statement describing it, using one or more universal laws together with certain singular statements - initial conditions. The author revives the notion of principle of causality (Heinrich Gomperz) in the theory of cause and effect relations. On the basis of this principle, Popper proposes the following rule to researchers: researchers should not abandon the search for universal laws and well-structured theoretical systems, or attempt to give a causal explanation of any events that we can describe. “The goal of the theorist is to find explanatory theories describing certain structural properties of the world and allowing us - with the help of initial conditions - to deduce consequences that require explanation” (Popper, 2004, pp. 54-56).

It is convenient to represent the discovered cause and effect relations of the phenomena and the process of their formation in the form of a causal diagram of Kaoru Ishikawa (1950). The causal diagram (Cause-and-Effect-Diagram) of Ishikawa is a universal toolkit for modeling the origin of causes and conditions that set in motion a phenomenon from a known beginning to the desired result. The named diagram allows to group factors — causes of the first order (“large bones”), second order (“medium bones”), third order (“small bones”), i.e. to see in graphic form the causes that led to the occurrence of the problem, the details of the causes and clearly see what needs to be done so that the cause in its development becomes a consequence.

As part of our theoretical research, it is necessary to dwell on Samantha Kleinberg’s (2017) work. In her book “Why: A guideline for finding reasons and making a decision”, the term “cause” means something that increases the probability of an effect, without which an effect could or could not happen, and is capable to produce this effect in proper circumstances. In terms of content, such approach to the definition of “cause” resembles the theoretical research of Russkov “Philosophy of the “butterfly effect” and “butterfly effect” in philosophy” (2012).

Samantha Kleinberg in her work pursues the goal, namely to reflect the advantages and limitations inherent in various approaches, but not to make methodological recommendations, since in her opinion, they are not absolute. At the same time, she believes that knowledge of the causes gives more rigorous methods for predicting events than correlation.

Finally, the scientist concludes: “We obtain knowledge of the causes in two ways: through perception (casual experience) and reasoning (indirect conclusions about causality using the deductive method and on the basis of non-causal information)” (Kleinberg, 2017, p. 35).

Methodology

Theoretical and empirical methods

To test the research hypothesis based on the fact that the process of forming competencies for innovative activity of future primary school teachers depends on taking into account the implementation in the pedagogical reality of stable cause and effect relations of the pedagogical interaction of teachers and students in an innovative educational environment, at the first stage of the study various methods of scientific research were used: theoretical (analysis of scientific, philosophical, methodological, special literature; methods of theoretical modeling; analysis and synthesis); empirical (generalization of innovative experience of teachers of higher education institutions; conversations, surveys, interviewing; pedagogical experiment; monitoring the results of joint activities of teachers and students; analysis and comparison of the study results based on statistical data; questioning and testing participants of the experiment).

We believe that the main feature of any theoretical substantiation of the research is a hypothetical nature of description of the studied phenomena, which requires experimental evidence. In our case, the proof will be the discovery of patterns of causal relationships in the interaction between university applicants, teachers and students in the process of forming competencies for innovative activity of future teachers.

Research base

The study was conducted on the basis of the Institute of Psychology and Education of the Kazan (Volga Region) Federal University (Kazan) and Chuvash Republic Budget Institution of Additional Professional Education “Chuvash Republican Institute of Education”, the Ministry of Education of the Chuvash Republic, (Cheboksary). The first stage of the experiment involved more than 250 participants.

Stages of research

At the first stage, the singularity (from Latin singularis - “alone of its kind”) of our approach to solving the research problem was determined. A research program was designed.

At the second stage, it is planned to create and prove a model of cause and effect relations contributing to the formation of readiness of future primary school teachers for innovative activity, as well as to develop and test diagnostic tools (evaluation criteria) to identify the level of teachers’ readiness for implementation of innovations.

At the third stage, a unique program on the development of teachers’ readiness for innovative activity will be developed and introduced into the university’s practice.

The course and description of the experiment

The study was carried out on the basis of the Institute of Psychology and Education of the Kazan (Volga Region) Federal University, the Chuvash Republic Budget Institution of Additional Professional Education “Chuvash Republican Institute of Education”, and the Ministry of Education of the Chuvash Republic.

On the basis of generally accepted methods, the future teachers identified the reasons for their

choice of the teaching profession as a consequence of the results of the influence of many factors. A sampling was made for a larger quantitative indicator of the above reasons. We received a complete picture-consequence, due to the social position of applicants, formed on the basis of acquired sociocultural competences in the process of socialization and education.

Results

For the experiment we have developed a program where the goal, tasks, the hypothesis were specified. The main task at the first stage of the research was to determine and identify random, probabilistic, deterministic, dynamic, statistical reasons which led the future teachers to a pedagogical university. The ratio of these reasons to each other is given in Table 1 below.

Table 1. The results of the ascertaining experiment

| o. | Reasons that influenced the choice of the teaching profession | % indicators |
|----|---|--------------|
| | The presence of teachers in past generations | 6.8 |
| | Pedagogical potential of the family | 11.2 |
| | Affection for the first teacher | 13.4 |
| | Positive example of professional excellence | 9.8 |
| | Motivation to learn (internal and external) | 9.6 |
| | Self-education and self-studying | 6.4 |
| | Professional information and vocational guidance | 8.9 |
| | Additional education | 6.2 |
| | Specialized education | 12.4 |
| 0 | Participation in contests and competitions | 2.2 |
| 1 | Active educational and project research work | 7.8 |
| 2 | Participation in voluntary service | 5.3 |

The ascertaining experiment reveals the main causes and factors of the second and third order. The process of analyzing the data in Table 1 contributes to the disclosure of hidden direct and inverse dependencies of cause and effect relations as a result of judgments and conclusions. On the basis of the received information, we can determine the nature of cause and effect relations, such as hereditary, deterministic, social, informational, one-factor, multifactor, external and internal, main and secondary, etc. Table 1 clearly shows what issues the career guidance specialists should focus on working with school leavers so that future teachers choose their profession due to dedication.

Discussions

We invite readers and colleagues from other universities to discuss our assertion that the classification of types of causes and cause and effect relations is one of the difficult scientific problems in the educational theory. Establishing cause and effect relationships in the process of forming competencies for innovative activity of future primary school teachers is the most topical issue. This problem can be

solved if the research methodology builds on a correct algorithm: establishment of direct and externally presented dependencies between the existing characteristics of cause and effect relations (random, probabilistic, dynamic, static, etc.), determination of hidden direct and inverse causal dependencies; modeling of cause and effect relationships between the consequences of the educational process; construction of the trajectory of development of each student on the basis of a student-centered approach to the formation of the necessary and sufficient pedagogical competencies.

We believe that the main feature of any theoretical substantiation of the study is a hypothetical nature of description of the studied phenomena, which requires experimental evidence. In our case, the proof will be the discovery of patterns of causal relationships in the interaction between students and teachers in the process of forming competences for innovative activities among future teachers.

Conclusion

In conclusion, it is necessary to emphasize that the theoretical analysis of the cause and effect relations of pedagogical phenomena is intended to be a holistic reflection of the regular and essential relationships in the pedagogical reality.

As the main functions of our theoretical analysis of the cause and effect relations of pedagogical phenomena we should highlight: synthetic, explanatory, methodological, predictive, practical, communicative, educational, and other functions.

Our theoretical studies, being a generalization of scientific and methodological experience and the practices, applied in the process of forming competences for innovative teaching, reveal and determine the perspective of student teachers' creative activity. In this regard, another causal necessity arises. The provisions of any theoretical research can and should be verified by practice and experience. Practice is the most important criterion of truth in theoretical conclusions and statements.

The innovation process as a certain system represents integrity in all stages of its life cycle and in all its internal and external relationships.

Based on the generalization of the existing experience, it is necessary to identify the factors contributing to the intensification of the innovation process in the activities of a teacher:

- creative potential of school leaders;
- developed complex projects;
- consultation in relation to projects and the process itself;
- socio-economic environment;
- share positions of participants in the innovation process, from which it follows that the

innovation process always has a certain direction. One of them is the focus on teaching. As we can see, the teacher's innovative activity is not only related to the ability to solve certain problems, but also to the presence of a multitude of causal connections for which it is necessary to prepare a future teacher within the conditions specially created at the university.

Therefore, many cause and effect relations are at the core of the actual implementation of innovative activities in the field of education. This includes an ability to form the conceptual basis of pedagogical innovation, including diagnostics, prediction, development of an experiment program, analysis of its implementation, monitoring the progress and results of implementation, correction and reflection of innovative actions. A prerequisite for the successful implementation of teaching innovations is the ability to make an innovative decision, take a certain risk, successfully resolve conflicts that arise during the implementation of innovations, and remove ant barriers.

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