Self-education Competence of Future Teachers: Diagnosing by Computer Analyses of Student Essays

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ABSTRACT

Our research is aimed at finding adequate ways to diagnose self-education competence of future teachers. Writing a prognostic essay, revealing students' positions, was chosen as the final diagnosis in their training. This research consists of the development and testing of diagnostic tools and the diagnosis of self-education competence of future teachers by means of a computer analysis of student essays. The fundamental basis of this study is predictive and didactic in nature. The leading research methods were the following: a theoretical analysis of the essence, structure and main features of future teacher's self-education competence, technical and technological methods of designing computer analytical tools for the content analysis of essays (with the elements of formalization and intellectual analysis of text documents), methods of expert systems (used to solve the problem of choosing and systematizing marker words), experimental pedagogical methods (including a pilot experiment and formative assessment). The research involved students of the Institute of Psychology and Education of Kazan Federal University: 263 students - at the stage of the pilot study, 134 students – at the stage of the formative assessment (the participants are enrolled on the program 44.04.01 – Teacher Education (Master's). At the stage of the formative assessment, using the final essay content analysis, tables with the results of diagnosis of motivational-value, reflective-evaluative, and cognitive-activity components of self-education competence were created. A reflective comparison of the results of student essays computer analysis and own assessment of self-education competence provided data for the further improvement of diagnostic tools. Statistical data processing provides results of the self-education competence both of an individual student and groups, cohorts, and all students of a specific training program. The development of self-education competence allows a person to obtain the required authority in the field of education, to preserve and increase his/her competence in solving professional problems. The materials of the experiment made it possible to systematize the key words prevailing in student essays and combine them into the basic blocks of markers. Presence and occurrence frequency of these markers in a certain part of the analyzed text indicates a certain development level of self-education competence. The materials presented in the article describe the proposed tools for content analysis, which is built on the basis of specially grouped marker words, can be used in pedagogical practices. A free-form essay is digitized which allows us to quantitatively assess the given components of subject's self-education competence.

CCS CONCEPTS

• **Social and professional topics**;

KEYWORDS

self-education competence, components of self-education competence, content analysis, marker words

1 INTRODUCTION

The current study is aimed at diagnosing self-education competence of future teachers. The development of self-education competence defines, mainly, whether a person will receive the required authority and whether he will retain his competence in solving professional problems, which confirms the relevance of the claimed study. Building the self-education competence has many aspects as a scientific problem. For the most part, it is associated with the personality orientation, its motives for self-improvement and development of professional competence [8] of students. Researchers such as T.E. Zemlinskaya, E.A. Zlotnikova, E.S. Chebotareva and others substantiate the idea that self-education is a basic competence [1, 10, 11], which forms a number of other competencies. Based on their researches, it may be concluded that the authors distinguish the following components as basis for a structure of self-education competence: motivational, reflective, cognitive and activity.

In our study, we point out that the development of self-education competence reflects a systemic nature, and includes the following integrated processes: awareness of teacher's professional and creative self-education as a value, professional and personal self-actualization, self-control, self-esteem and self-reflection of a future teacher, self-education and self-fulfillment in a professional setting. In order to take into account the degree of integration of the

indicated processes, the current study examines the combined components [4], which form the basis of teacher's self-education competence: motivational-value, reflective-evaluative, and cognitive-activity. Therefore, the identified motivational-value component of a competence is considered as the basis for other components development: professional and creative self-development of teacher's personal and professional self-education.

The stated subject of our study - diagnosis of teacher's self-education competence - implies verification teacher's ability to adapt to modern requirements and changing conditions. We chose a prognostic essay as a final task for students; it allows to indicate an analytical focus, and shows the usage of the learned techniques of self-education activity in overcoming possible difficulties. Therein, a student analyzes a specific situation and substantiates the ways to achieve a goal.

In general, it is necessary to identify the extent of knowledge and experience, which help a future teacher to maintain successful professional activity in conditions of dynamic development of the information society [5]. In this article, the diagnosis is based on three main components of self-education competence. A motivational-value component is reflected in a diagnosis through the possible identification of an internal motive, as well as through building short-term and long-term goals for oneself and one's student. A reflective-evaluative component is characterized by a critical (reflective) assessment of students and oneself. This component is directly related to positive self-esteem, satisfaction with one's own activity and the activity of one's students. A cognitive-activity component is associated with a technology (by the way of applying knowledge) or a technique (in achieving professional tasks).

2 PURPOSE AND OBJECTIVES OF THE STUDY

As already stated above, the purpose of the study is predictive and didactic in nature and involves: development and testing of diagnostic tools, and diagnosis of self-education competence of future teachers using a computer-based content analysis of student essays.

Therefore, it seems relevant to use computer tools, including:

- preliminary formalization of the text of student essays and identification of key markers which represent the formed self-education motives, experience of successful activities and adequate self-esteem,
- subsequent content analysis based on counting the frequency of relevant markers found in student essays which reflect quantitative characteristics for the selected components of self-education competence,
- reflective discussion of diagnosis results as the basis for ensuring the effectiveness of computer diagnostics and self-assessment of the formation of future teachers self-education competence.

3 LITERATURE REVIEW

The following interconnected components were taken in this study as the basis of the self-education competence structure: motivational-value, reflective-evaluative, and cognitive-activity.

The motivational-value component starts with an internal motive, which helps to organize behavior and builds the personality

orientation and construction of competitiveness as well as short-term and long-term career goals.

In substantiating the motivational-value component, in the current study we relied on the following ideas. Professional self-education is recognized as a universal value, since motivation is determined by a developed moral-volitional sphere. The most effective way to stimulate professional self-education of a future teacher in a pedagogical way is to influence his attitudes, interests, desires and values. The same position is reflected by Zlotnikova E.A. [11]. She emphasizes the need to establish self-education competence as a value and highlights the "criteria for self-education competence":

- emotional - reflects a conscious self-educational activity, which significance increases both for professional and personal improvement, which, in turn, can be achieved through a value attitude to that activity;
- motivational - implies a pursuit of the demanded development of self-education competence;
- gnostic - involves a study of information flows and, on its basis, identification of the self-education essence as a professional value and personal wealth, notably understanding of the ways of obtaining knowledge is more important than its availability;
- regulatory - involves the use of self-regulation and self-control skills;
- organizational - reflects the use of organization and management skills, suitable for new conditions of the information society and their systematic independent application.

Regarding the motivational-value sphere of a personality, it should be noted that the main purpose of the wish for professional growth is focusing on education and self-education of one's students and development of their motives for self-education as a value of a harmoniously developed personality. The highest degree of a professionally developed motive of a teacher will be considered the desire to achieve mastery and become a role model for future students. This is possible when the motive for self-education is directed not only at oneself, but also at a student.

The reflective-evaluative component can be characterized by a pronounced ability to self-regulation, critical self-reflection, forecasting, control and self-control of own actions. In the context of this study, it is an analysis of one's feelings and experience, one's own knowledge of teaching methods (methods, techniques and pedagogical abilities) to convey knowledge to their students, as well as a time frame assessment. In addition, it is also an assessment of the school curricula content, an assessment of one's own ability to single out the main and the essential idea. The reflective-evaluative component is directly related to positive self-esteem, satisfaction with one's own activities, which, in turn, are connected with self-control and enjoying the process of acquiring new knowledge and teaching students.

The cognitive-activity component is a cognitive ability [2, 6] to: conduct developed mental activity, learn, imagine, demonstrate creativity, represent spatial model; it first leads to generalized skills, and then, ultimately, to formation of educational and professional activity, that is, to developed professional skills and mastery in future activities.

The cognitive-activity component as a subsequent set of educational and self-education activities is related to the choice of a technology, methods of applying knowledge or techniques to achieve professional tasks, as a result of analysis, generalization and synthesis of information received.

The declared components of the development of self-education competence are quite difficult to evaluate. Saying so, we explain it by the fact that the processes of formation and development of all self-education competence components are directly related to its scientific and methodological support, pedagogical functions and pedagogical skills of a future teacher (such as designing, organizational, communicative, gnostic, research and integrative). As a result of the theoretical analysis of literature resources and researches of various authors, we can conclude that there are no common views and approaches on evaluation of these components development of, since they are difficult to assess. It is complicated to differentiate personal motivation and values, reflection and self-esteem assessment, cognitive sphere of an individual and activity.

4 RESEARCH METHODS

Research methods include a theoretical analysis of the essence, structure and characteristics of future teacher's self-education competence, technical and technological methods for designing computer analytical tools for content analysis of a final essay (including elements of formalization and intellectual analysis of text documents), methods of expert systems used to solve a problem of selection and systematization marker terms, experimental pedagogical methods, including pilot and formative assessments.

Content analysis, as one of the techniques for collecting information [7], based on a systematic identification of texts characteristics, allows getting an idea of distinctive features of each essay by using key concepts and phrases. Content analysis can be substantive and structural. Substantive content analysis focuses researcher's attention on the content of a message, while structural analysis focuses on the quantity and characteristics of a checked term. As a process, content analysis of a quite informative text and then subsequent calculation of various terms and markers by an expert is a laborious process, and usually its result depends on various random factors [9]. Improving the objectivity of text content analysis by means of Google Forms allows counting the frequency of mentioning various terms in a text.

The study involved students of the Institute of Psychology and Education of Kazan Federal University: 263 students - at the stage of a pilot study, 134 students - in a formative assessment (participating students study in a training program 04.04.01 - Pedagogical education (Master's). Students were asked to write an essay on the topic "Self-education of a future teacher."

The Google platform tools [4], in particular Google Forms, were used for writing and evaluating essays. By its specificity, analysis of essays, by the means of this Form, provides the content analysis of student essays.

5 CONCLUSIONS

Evidence shows that the analysis of student essays, being carried out in traditional ways, is often quite subjective. Therefore, it seems

relevant to use computer tools, including: a) preliminary formalization of an essay text, b) subsequent content analysis based on relevant markers, c) reflective discussion of diagnosis results. The relevance of this pathway is due to the fact that essay analysis provides achievement of a number of targets, specified at the stage of formal selection of text parts and correlation with significant diagnostic markers. The degree of achievement of self-education competence targets reflects the frequency of certain markers, calculated in a content analysis. Development of self-education competence and improvement of further usage of computer-aided diagnosis is provided in the process of reflective discussion, where it is replenished the database of agreed facts, adequate markers and achievable targets. Among these targets, we note analytical orientation of the research subjects performing the creative task, mastering the methods of self-education activity, as well as the ability to pedagogically transmit the learned methods to future students.

For the development and testing of diagnostic tools, we have identified marker words that constitute a set of indicators for self-education competence development. In turn, marker words were divided into blocks which specifically characterize indicators reflecting motivational-value, cognitive-activity and reflective-evaluative components.

For instance, when assessing the motivational-value component, we highlighted marker words characterizing the desire for personal professional growth and self-fulfillment as well as orientation toward education and self-education of one's students and development of their motives for self-education. We attributed the following words and phrases to these marker words: "self-education", "self-education of one's students", "motivation", "motivational sphere of personality", "motivational attitude", "motivational orientation of activity", "features of self-education", "features of my students' self-education".

When assessing the reflective-evaluative component, we selected the words which characterize the expressed ability to self-regulation, critical self-reflection, forecasting, control and self-control of actions, analysis of own feelings, experience, and knowledge of teaching methods, self-assessment of the ability to highlight the main and essential. We attributed the following words and phrases to this block: "own result", "reflective-evaluative position", "need for professional self-development", "pedagogical reflection", "functions and components of reflective assessment", "reflective-evaluative activity".

Assessing the cognitive-activity component, we highlighted the words and phrases that determine the development of professional skills and mastery in the future professional activity. We singled out the following words and phrases and subsequently attributed them to marker words: "manifestation of a personal position", "manifestation of personal position in a professional activity", "creation of new pedagogical technologies", "designing teaching techniques", "solving theoretical and practical problems".

It should be noted that all three of the stated components of the self-education competence development are revealed depending on the areas of pedagogical activity associated with self-education processes:

1. activity aimed at personal self-education,
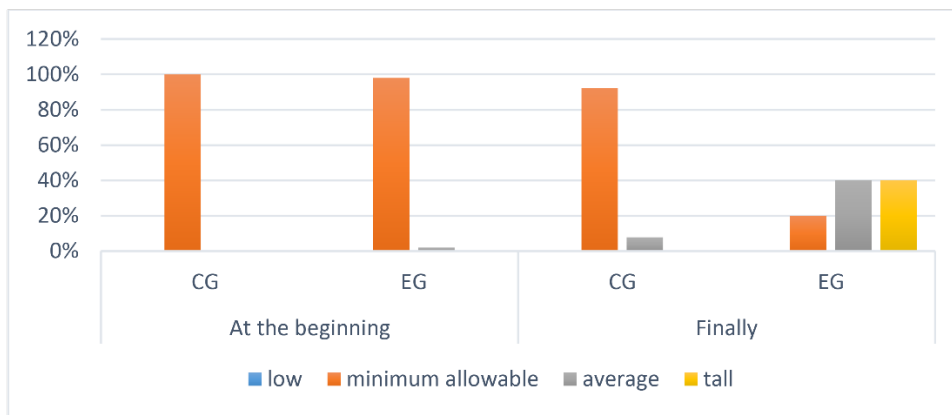2. activity aimed at organizing self-education of a student,

Figure 1: The level of assessment of motivational-value component of self-education competence
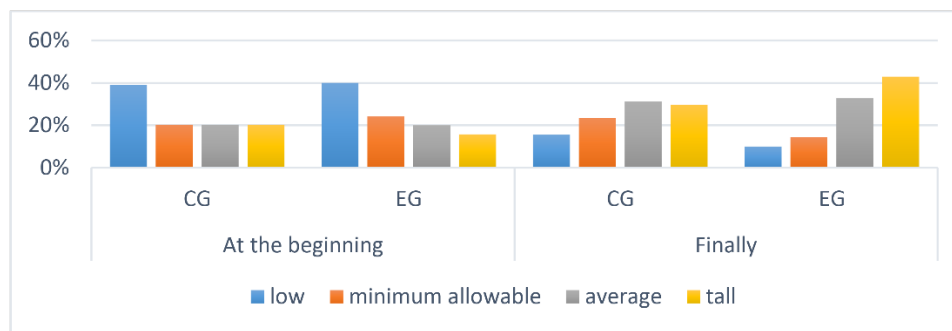

Figure 2: The level of assessment of reflective-evaluation component of self-education competence

3. activity aimed at the use of visual means of information educational environment in organizing self-education of participants of the educational process.

Thus, the materials of the pilot experiment made it possible to systematize prevailing marker words and combine them into blocks, on their basis there was calculated frequency of their occurrence in texts experimentally prepared by the respondents. The analysis of the similarities and differences grounds on what is mainly repeated at different stages and levels of solving the problem described in the essay. The prevailing markers make it possible to assess the state of the selected components of self-education competence. First of all, experimental data were collected. On its basis the digitization procedure was set up using the mechanism of an expert system which passed "training" on the results of the study groups' work; the diagnosis of achieving competencies in those groups was carried out by other means. This stage made it possible to adjust the system for the future assessment of essays and create blocks of markers.

Then, at the stage of the formative assessment, using the content analysis, there were analyzed final essays of Master students who were divided into an experimental group (EG) and a control one (CG). Based on the analysis of the created blocks of marker words, diagrams were constructed showing the diagnosis results of motivational-value, reflective-evaluative, and cognitive-activity components of self-education competence.

Assessment of the motivational-value component development results is presented in a figure 1 «The level of assessment of motivational-value component of self-education competence».

The reflective-evaluative component development results are presented in a figure 2 «The level of assessment of reflective-evaluation component of self-education competence». This diagram clearly illustrates a shift in the reflective-evaluative component development in terms of levels mastering.

The cognitive-activity component development is presented in the third figure 3 «The level of assessment of cognitive-activity component of self-education competence». It also clearly represents a shift in the cognitive-activity component developent in terms of levels mastering.

Thus, it should be noted that the results of the control stage of the experiment show positive dynamics in the development of the self-education competence components, which is proved, for example, by the following results.

The fourth (high) level of the cognitive-active component development is characterized by a creative, combinatory use of visualization tools in the process of organizing students' self-education and a focus on transferring to students one's own self-education experience using visualization tools. This level is shown by 15.7% of students in the experimental group, when in comparison with the pilot stage results, no one in the experimental group reached this
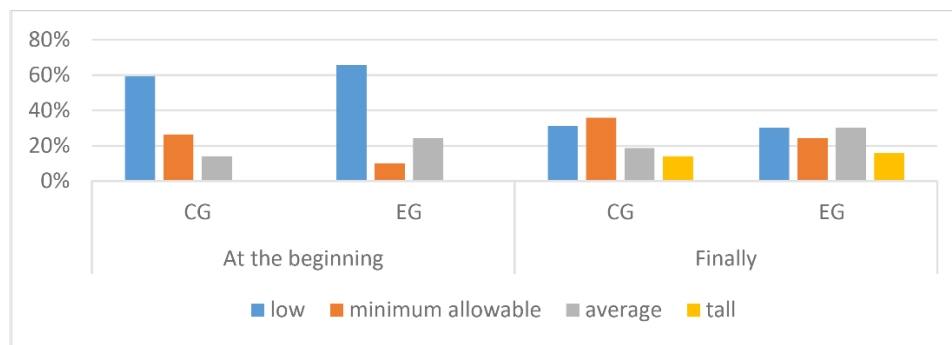
Figure 3: The level of assessment of cognitive-activity component of self-education competence

level. The proportion of students in the experimental group who reached the fourth (high) level of mastering the reflective-evaluative component increased by 27.1%, and for the control group this increase was significantly less.

As a result, we can conclude that the study has a predictive and didactic character. Its practical value is the development and testing of diagnosis procedures which allow us to analyze the final task results from different angles and draw adequate conclusions. The development of tools and diagnosis procedures for the self-education competence of future teachers in the process of final essays content analysis contributes to solving a specific problem situation by students.

Diagnosis provides adequate data on three basic components of self-education competence. The motivational-value component is reflected in the diagnosis by the possible identification of an internal motive, as well as by building a complex of short-term and long-term goals for oneself and one's students. The reflective-evaluative component is characterized by a critical evaluation of students and self-reflection. The reflective-evaluative component is directly related to positive self-esteem, satisfaction with one's own activity and activity of one's students. The cognitive-activity component is associated with technology (by the method of applying knowledge) or a technique in achieving professional tasks.

The components of self-education competence considered in the study are of a united nature. For instance, the identified motivational-value component of the competence is considered as the basis for other components development, including professional and creative self-development of teacher's personal and professional self-education.

The study results can be used in pedagogical practice, where it is required to take into account the dialectical nature of the systemic development of future teachers' self-education competence. It will support the proposed content analysis tools, built on the basis of marker words which were specially grouped and completed with weighting factors.

Thus, a prepared essay using Google Forms gets a digitized image which allows us to quantitatively assess the given components of subject's self-education competence. Statistical processing, with the given marker words usage, provides results of the self-education competence both of an individual student and groups, cohorts, and all students of a specific training program.

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