Analysis of foresight competency development model components in future ecologists

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Abstract: The article describes the role of foresight technology in environmental forecasting in the creation of future development strategies, and the analysis of some ecological scientific projects and programs implemented on the basis of foresight. The main components of the model of eco-foresight competence development in future ecologists are based and its evaluation criteria are defined. The results of the experimental tests carried out to determine the level of development of eco-foresight competence are presented, and foresight is used in the competitive and rapidly changing economic conditions of enterprises and companies in the production of clean ecological products and in predicting the future impact of technological processes on the environment, in drawing up long-term strategic plans or road maps, it is based on the fact that it is a highly effective method of ensuring their execution and control.

1 Introduction

In Uzbekistan, environmental education is one of the priority areas of higher education. Therefore, ecology is being taught in all bachelor’s programs in the higher education system. In order to further develop ecological education, the decision No. 434 of the Cabinet of Ministers of the Republic of Uzbekistan dated May 27, 2019 "On approval of the concept of development of ecological education in the Republic of Uzbekistan" was adopted and its implementation is being ensured. From the largest ecological problems, studying the consequences of local environmental problems and the production of clean ecological products in enterprises, the creation of clean ecological areas is related to the ecological reduction of the consequences of these problems. Today, it is used as a key technology in all developed countries for environmental forecasting and creating future strategies.

Currently, foresight technology is used as a key technology in creating future strategies in all developed countries. In Europe, universities are actively involved in the assessment of future activities, in the creation of special portals and systems, focusing on the technical aspects of forecasting based on European educational programs. Manchester University (Great Britain) can be cited as an example of creating a foresight system and predicting scientific and technical directions. Another university based on the results of foresight research is Sigularity University, which was established by the American Aerospace Exploration Agency (NASA) in cooperation with multinational corporations such as Google, E-Republic, Autodesk, Cisco, etc.
Higher educational institutions of Russia began to occupy an important place in the system of determining and predicting the main trends in the country's scientific and technological development. In 2011, a regional network was formed in order to predict the scientific and technological development of 6 prestigious universities. The main activity of this network is to establish a permanent connection between experts in education, research, government and business community, to support them and to attract experts to Forsite studies.

BEFORE (Becoming Future-Oriented Entrepreneurs in Universities and Companies) in the project “Training of future-oriented entrepreneurs in universities and companies” foresight programs conducted by universities of developed countries were extensively and comprehensively analyzed. This project is the ERASMUS + project that was funded under the Knowledge Alliance scheme. The goal of the project is to transform business education with university education and to train company employees on business practices. It contains information about the foresight studies carried out by higher education institutions in countries such as the USA, Denmark, Poland, Germany, Canada, Australia, Great Britain, South Africa, Finland, and Malta. By foresight A. Curaj, L. Andreescu, I. Eydis, TV Khrennikova, V. Ya. Kasans, A. B. Cherednyakova, G. M. Cossacks conducted scientific research.

2 Methods

Pedagogical observation, comparative analysis, generalization, pedagogical experiment, mathematical-statistical analysis, mental cards, expert survey of foresight, development of scenarios, future box, and Delphi methods were used in the research process.

3 Research results and discussion

In future ecologists, there should be an integral connection between the main components that determine professional competence and the components that determine the eco-foresight component, because the foresight component is an integral part of the professional component.

Cognitive, motivational, reflexive, regulatory, and affective components were selected in this study in order to control and evaluate the development of eco-foresight competence. In models of development of professional competence, most authors are limited to cognitive, motivational, and reflexive components, unlike in our model, regulatory and affective (emotional) components were also included, taking into account that ecologists were management personnel.

Table 1.

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<th>Degree</th>
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<td>Low</td>
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Reflexive
The student knows that he does not always apply the methods of control - evaluation activities in practice; underestimates his own strength, lacks self-confidence in using his foresight knowledge in his professional activities.

Regulatory
He cannot quickly adapt to changing conditions, it is difficult for him to clearly imagine the decisions made and their consequences, he has little responsibility for his work and he cannot evaluate his knowledge, skills and other resources.

affect (emotional)
He cannot fully imagine his ability to function as a manager, he has difficulty predicting the future of his professional career, he is quick-tempered, it is difficult for him to accept the opinion of others, he is nervous in debates.

Medium
Cognitive
The student has theoretical knowledge of foresight technology and its methods, can determine the essence of the problem from the point of view of professional activity, knows the selection and use of the foresight method, forecasting, analysis, strategic plans and roadmaps, but has difficulty in independent application.

Motivational
Foresight is motivated and interested in technology and predicting the future, realizing that the foresight will be needed in future careers.

Reflexive
The student knows and uses methods of monitoring and evaluation activities in practice, believes that he can use theoretical knowledge to solve practical tasks, there is a desire to manage his educational process and expand his knowledge, the student has the skills of self-monitoring, evaluation and development.

Regulatory
Able to adapt to changing conditions, imagine the decisions made and their consequences, feel responsibility for his work and evaluate his knowledge, skills and other resources.

affect (emotional)
He believes that he can act as a manager, he knows the future of his professional career, he can evaluate his character, he can control himself, but he has little patience to listen to the opinions of other people, and he tries to share his opinion.

High
Cognitive
The student has acquired sufficient theoretical knowledge of foresight technology, can justify the choice of foresight methods in forecasting and its application, fully understands the necessity of foresight in his future professional activities, has mastered the skills of forecasting the future, strategic planning and analysis, predicting possible crises and consequences.

Motivational
Strong motivation to fully learn his profession and foresight technology, understands and applies the importance of foresight in his future career.

Reflexive
The student knows and uses in practice the methods of controlling and evaluating activities, can highly evaluate his personal skills, is confident in applying theoretical knowledge when solving practical problems, has mastered the skills of planning, organizing and correcting educational activities.

Regulatory
Can quickly adapt to changing conditions, imagines the decisions made and their consequences, feels responsibility for his work and can evaluate his knowledge, skills and other resources.

affect (emotional)
He fully believes in his ability to act as an ecologist, he can predict the future of his professional activity, he does not give in to emotions, he can listen to the opinion of other people in management activities.
As a result, during the student's study period, it is envisaged that management levels (ecologist) with a high level of eco-foresight competence will be formed. In the effective operation of managers, the issue of achieving the planned result is in the first place, other factors of foresight competence (knowledge, skills, abilities, etc.) are auxiliary components in relation to the achieved result (Sodikova, 2014).

Based on the criteria and levels (see Table 1) that determine the formation of eco-foresight competencies, the level of formation of cognitive, motivational, reflexive, regulatory, and affective competencies in students was studied and analyzed.

The results of determining the active component of cognitive (Cognitive development) were as follows. During the experimental period, the level of formation of students' cognitive abilities on foresight was determined by the level of memorization, perception, logical and creative thinking, and independent decision-making. Due to the fact that foresight is a new concept, the process of thinking logically about the meaning and purpose of foresight was slow. Foresight methods and the level of formation of skills in their use were quite active.

The analysis of the test results showed that 28 (17%) of the 163 students who participated in the test had a high level of cognitive activity, 93 (57%) had a medium level, and 42 (26%) had a low level of cognitive activity. Many respondents reported that they perceived foresight as a method of predicting the future, so 26 percent of students were judged to have a low cognitive performance component (see Figure 2).

Results of determining the motivational activity component. The diagnosis of the results of the experiment showed that the motivational activity component is at a high level, especially among the students who are consciously choosing their profession. Of the 163 students who participated in the experimental tests, 62 (38%) had a high, 70 (43%) had a medium, and 31 (19%) had a low-level motivational activity component (see Figure 3).

![Bar chart showing the distribution of students' cognitive activity levels.](image)
Fig. 2. The level of formation of the motivational activity component in students. This indicator is much higher than the cognitive activity component, the reason for which is based on the fact that students have a strong interest in the managerial profession and that they realize that predicting the future through foresight, creating the future, and striving for it play an important role in their professional and personal activities.

Results of determining the reflexive component. The analysis of the results of the experimental research showed that 52 of the 163 students who participated in the survey (32%) had a high level of self-assessment and development skills, and 80 students (49%) had an average level of self-confidence in applying theoretical knowledge.

That is, he believes that he can use theoretical knowledge to solve practical tasks related to management in his professional activity, he understands the essence of self-development, he understands the essence of "Lifelong learning", he can control and evaluate himself, and he believes in his knowledge. However, there were cases of students in this category giving a high assessment of themselves, that is, to their theoretical knowledge and practical skills. This means that the student "could not evaluate himself objectively and correctly".

Fig. 3. Level of formation of reflexive component in students.
31 (19%) of the students who took part in the experiment have difficulties with self-assessment, they are not fully confident of using the theoretical knowledge and practical skills they have acquired in the foresight technology in their future life or professional activities, that is, the reflexive component is at a low level (see Figure 4).

**Results of determining the regulatory component.**

Interview and psychological test methods were used to determine this component in the experimental test work. Factors such as the future manager's ability to quickly adapt to changing conditions and labor relations in the market economy, to imagine the decisions and their consequences, to feel responsibility for his work and to evaluate his knowledge, skills and other resources were taken into account. Of the total of 163 respondents who participated in the pilot study, 57 (35%) had a high level, 73 had a medium (45%) and 33 (20%) had a low level of regulatory component (see Figure 5).

**Fig. 4.** The level of formation of the regulatory component in students.

**Results of determining the affect (emotional) component.**

The analysis of the results of the experiment showed that 86 (53%) of the total 163 students who participated in the experiment had a component of affect activity at a high level, 47 (29%) at a medium level, and 30 (18%) at a low level (see Figure 6).

**Fig. 5.** The level of formation of the regulatory component in students.
The analysis of the results of the experiment showed that the highest indicator is the motivational and reflexive component, that is, the future managers who participated in the experimental research have a great interest and desire to know the eco-foresight technology theoretically and practically. This result is explained by the fact that eco-foresight can be used not only for predicting the future of an enterprise or company, but also for creating one's life activity and personal future.

Eco-foresight can be used to predict the promising future in various fields during the career of future professionals. Eco-foresight studies were also conducted on the issue of wider development of the use of digital technologies in the higher education system of Uzbekistan. For example, "Using Foresight methods, the interests, opportunities and perception of digital technologies by the main participants in education, as well as the consequences and social risks of digitalization of higher education, were studied. The necessity of systematizing the social effects of digitalization of higher education and, in the future, carrying out the corresponding complex research has been substantiated" [11].

Also, in order to develop the agrarian sector, including cotton production in Uzbekistan, conducting scientific research on forecasting the impact of underground water on cotton yield, and on the reserve of underground water in general, will have a good effect. For example, as a result of phenological observations, it should be noted that due to soil salinity in the first field and unfavorable water-physical properties of the second field, the growth of cotton in all variants was relatively weak, the number of pods decreased and the cotton harvest was slightly lower.

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4 Conclusions

The formation of "Eco-foresight competence" in future ecologists is eco-foresight-management, that is, it forms the strategic planning abilities of the ecologist and the ability to understand the responsibility for his decision, and is a management methodology. This allows future ecologists to fully develop their theoretical knowledge and practical skills in the field of enterprise management, human factor management, future development and competitiveness of the enterprise in the period of rapid changes. The analysis of the results of the experiment and test is the teaching of specialized subjects using foresight technology in the field of "Ecological" education and, as a result, the formation of foresight competence in them. In the competitive and rapidly changing economic conditions, future managers are high in predicting the future of the enterprise, drawing up long-term strategic plans or roadmaps, ensuring their execution, and monitoring. proved to be a very effective method.

References


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